Ref 71D

PLANT INTRODUCTION NEWSLETTER

Issued by Crop Production and Improvement Branch, Plant Production and Protection Division, Food and Agriculture Organization of the United Nations, Rome, Italy

No. 8 October, 1960

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NOTES

1. These Newsletters represent informal communications addressed only to persons who are directly and actively interested in plant exploration, collection and introduction.

2. It is regretted that it is not possible to issue complete versions of these Newsletters in the three working languages of FAO - English, French and Spanish. As news items are, however, included in the original language the Newsletter is thus published in a trilingual form.

3. The earlier issues of this Newsletter contained reports of expeditions planned or in progress. It would be greatly appreciated if those concerned could send a report of these expeditions as soon as possible for inclusion in a later issue of the Newsletter.

4. All correspondence with regard to the above items should be addressed to the institutes or specialists concerned, or to: Dr. R.O. Whyte, Chief, Crop Production and Improvement Branch, FAO, Rome, Italy. Those wishing to be included in the mailing list for further issues of these Newsletters are requested to inform the above if they have not already done so.

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138. German Botanical and Agricultural Expedition to the Andes 1959

H. Ross
Max-Planck-Institut
Köln-Vogelsang, Germany

In 1930 the Max-Planck-Institut für Pflanzenzüchtung formerly the Kaiser-Wilhelm-Institut für Pflanzenzüchtung in Müncheberg/Mark, sponsored its first expedition to the gene-centers in South America. This expedition was made by Professor Dr. Erwin Baur, Professor Dr. H. Schick and Dr. K. v. Rosenstiel. Since then the study of the material collected by this expedition has been completed. Several new points of view came to light, and a second expedition was considered necessary to explore further this gene-center so important for many European cultivated plants (see Prof. Rudorf's article: Item 91 in Newsletter No.5).

Thanks to the initiative taken by Prof. Dr. Rudorf, the Ministerium für Landwirtschaft, the Deutsche Forschungsgemeinschaft, and the Max-Planck-Gesellschaft zur Förderung der Wissenschaften recognized the significance of such an expedition and provided its support.

The expedition also aroused the interest of Prof. Dr. Straub, of the Botanical Institute of the University of Cologne, who planned to investigate the chromosome geography of Andean plant species at different altitudes.

Since Vavilov it has been known that the Andean region represents a center of variation for potatoes, tomatoes, beans, and other cultivated plants. Today plant breeders are very much interested in disease resistance. In this Andean gene-center, the plants and their pathogens have been in contact for a long phylogenetic time. It is therefore to be expected that the plant hosts have developed defence mechanisms of great diversity, while correspondingly the pathogens have increased the number of their mechanisms for aggression. It was one of the main purposes of the expedition to find greater resistance, especially to the leaf-roll virus, Phytophthora infestans, Alternaria solani, Actinomyces scabies, Heterodera rostochiensis, Rhizoctonia solani, and Erwinia phytophthora. Moreover, the great number of wild species of Solanum (sect. Tuberarium), Lupinus and others required an intensive study of their habitat, ecology, and occurrence in specific plant associations. Variation in resistance to a given pathogen must be greatest where the host species occurs in an environment optimal for the growth of the pathogen. Among species where selection has operated in this manner, forms may exist which can withstand the whole range of pathogenic races, because the parasite may have realized all of its mutative possibilities in the original plant population.

Another important aim was to clarify the taxonomy of certain cultivated species. Order in taxonomy is an urgent necessity, not only for general work with wild species, but also for the solution of special problems.

The importance and large number of wild species of Solanum (about 150) corresponds to the number of investigators in this scientific field. There is a great need for living and herbarium material of the wild relatives of many cultivated plants. After elucidation of the cytogenetic relations among the wild species and the cultivated forms, the way is open for the transfer of resistance genes to the cultivars, and for the understanding of how the cultivated forms have originated and developed.

It is not sufficient for the plant breeder to have only one sample of a wild species. It has been found that within a wild species there may exist different forms which exhibit susceptibility as well as variable types of resistance. To have a susceptible form, as well as a resistant one, is advantageous in the investigations on inheritance, because the results of intraspecific crosses can be interpreted more conclusively than those of interspecific crosses.

The section Tuberarium of the genus Solanum is a polyploid series that is well suited for cytotaxonomic studies. Hawkes (see item 92 in Plant Introduction Newsletter No.5) has presented a hypothesis for the relationship of the Mexican species to the South American ones. With sufficient material at hand, it would be worth while to test this hypothesis.

Another task that should not be forgotten is an investigation, from a plant geographic point of view, of the center of origin not only of the tuberous Solanums as a whole but of the different series of that group.

An indispensable restriction was to concentrate our work in the Andean region on Solanum (sect. Tuberarium), Phaseolus, Lupinus and Lycopersicon. Prof. Rudorf made preparations for the expedition while on a trip which took him from Canada, the United States, and Mexico down to Peru, Bolivia and Argentina. He made contact with officials and colleagues and enlisted their help. Later this proved very useful to the success of the expedition.

The expedition itself was made by Dr. H. Ross and Dr. R. Rimpau, both of the Max-Planck-Institut, Köln-Vogelsang, and by Mr. L. Diers, of the Botanicial Institute of the University of Cologne. As is the case with any expedition, it was important to find the right vehicle. Because 4-wheel drive was indispensable, as well as sufficient room for 3 or 4 persons and their baggage, the range of choice in Germany was very limited. Correspondence with people in South America revealed that no suitable vehicle was available for the period it was required. We therefore bought a Dodge truck of 3/4 ton capacity, at an auction held by the U.S. Army in Germany, and transferred it to South America after remodelling it.

We reached Buenos Aires on 30 January 1959. After paying visits to several institutes we began the real expedition in Tucuman, accompanied by Dr. Vervoorst of the I.N.T.A. In addition to the Solanums, it was Phaseolus aborigineus which interested us in northern Argentina. The mountains of the Aconquija, the valleys of the Rio Santa Maria and of Humahuaca, the bolsones, and the beginning of the Puna were the places where we studied plant formations and collected 13 of the approximately 15 Argentinian Solanum species.

After reaching the Bolivian border the expedition split into two, as Mr. Diers had to make sprout tip preparations of as many species as possible of the main plant societies in the Andes, and his best way to work was to stay for some weeks in one place, making excursions to the plant associations nearby. He first went back to Tucuman to work in the Aconquija mountains and then by train without a stop to Cochabamba, where we met again later.

The other part of the expedition went immediately into Bolivia. In this country we were accompanied by Professor Dr. Cardenas and Ing. Agr. Alandia of the University of Cochabamba. Our investigations in the central plateaux and mountain ranges were completed by longer excursions to the eastern borders of the Andes, one trip taking us from Sucre to Monteagudo, the other from Cochabamba to Santa Cruz. In these regions we collected not only Lupinus and Solanums, but also ornamentals such as orchids.

The car did well on the roads which were mostly in bad condition and which we could sometimes use in one direction only on alternate days. Its shortcomings were weak springs and low speed, but a jeep was often put at our disposal by the Interamerican Agricultural Service to which we are indebted in many respects.

Although the year 1959 was not a favourable one for collecting potatoes, we succeeded in getting most of the Bolivian species and made many important observations with regard to their association with special plant formations. It was of great interest to study the relationship of species development and distribution to the agricultural activities of man. Some species seem to accompany man and occur very frequently on the edges of paths, on walls and in cultivated fields among cultivated potatoes, maize and other crops, but we observed as a general trend within nearly all Solanum species that they colonize open places and also occur in sparse formations in quite natural and undisturbed plant societies. It seems that from these places they have invaded man-created habitats because of their natural weakness in competition with other species and because, especially on the Altiplano, the original habitats are largely used for agriculture.

The very interesting plant society of the "Ceja de la montana" was studied near Comarapa and other places. This formation is characterized by high altitude, fog nearly every day and frost in the winter. Here occur the series Conicibaccata and Circaeifolia, which may include species with pronounced resistance to late blight.

Time was devoted to the region of Lake Titicaca, with its widely spread culture of Solanum andigena and other cultivated Solanum species with frost resistance, and we made a large collection of the cultivated forms from this and other regions. During this time, it was observed that not only the cultivated species S. juzepczukii, S. curtilobum and S. ajanhuiri have resistance to frost, but that some forms of S. andigena are also frost resistant. It was also found that virus diseases are very common in Bolivia and Peru, and that the viruses Y and X are particularly prevalent (as shown by the tubers on return to Germany). On all the collecting expeditions we tried to obtain berries, tubers and herbarium specimens, the tubers being sent immediately to Germany by diplomatic channels.

We crossed the Peruvian border at Yunguyo. In Peru we enjoyed the company of Professor Dr. Vargas, Dr. Carrillo (specialist in Lupinus) and Senor Perez and are grateful for the help they gave us. We also have to thank Dr. Vervoorst, Prof. Dr. Cardenas and Ing. Agr. Alandia for their assistance and kindness to us. They did a great deal to make the expedition a success.

Going out from Puno near Lake Titicaca, we first made collections in the Departementos Tacna, Moquegua and Arequipa, which are situated in southern Peru; we received only a few visits from collectors of Solanum and most parts have not been visited by them at all. We found some interesting species at high altitudes above 4,000 m., and studied the Puna formation of the pass regions of the western Andes. We then went down to the region of the Volcan Misti near the town of Arequipa, and on to Tacna and Moquegua. In these arid formations we were able to study the Solanum species of xerophytic habitats, and it was here that we found our first Lycopersicum species - L. chilense and L. peruvianum.

Back in Puno we took the inter-Andean route to Cuzco through the Altiplano. Abundant splitting off of forms and species of the series Tuberosa, which often have sharply separated zones of distribution, made it evident that the Altiplano is the center of origin of this series. Interesting observations were made concerning the relationship of wild and semi-wild Solanum species and agriculture. Dr.Carrillo, as a specialist in the genus, was very keen on finding and diagnosing species of Lupinus on our excursions.

Starting from Cuzco we visited the famous Urubamba valley with the anciant Inca town Machu-picchu. While the lower part of the valley was fruitful for obtaining wild species of Phaseolus as well as cultivated forms, we found higher up some species of Solanum series Conicibaccata which might be of importance because of their resistance to Phytophthora infestans. 14 collections of Solanum were made between Pisac and Cedrobamba. The expedition moved on via Sicuani to Huancayo, en route crossing several dry hot valleys of the inner part of the Andes which gave us a clear impression of their typical xerophile and mesophile formations. It became evident that the conditions of the mesophile formations are particularly favourable for the development of aphids. It may be assumed that the Solanum species of these formations exhibit some resistance to aphid-transmitted viruses such as the leaf-roll virus and virus Y.

We tried to collect not only wild species of potatoes but also cultivated ones, and a great number of these could be obtained in the markets or directly from the fields. Ing. Carlos Ochoa, whom we met in Huancayo, was kind enough to supply us with many cultivated forms from his collection.

Continuing our journey, we went on to Lima, collecting on the way some interesting species of Lycopersicum in the Rimac Valley. Lima (more specifically the Humboldthaus - a good place for working, and the living quarters of German scientists travelling in Peru) became our temporary headquarters, where we joined up with Mr.Diers again. There followed some excursions to the east-west valleys which lie north of Lima and to Huarez. Here again we were surprised to find interesting Solanum species, some probably new ones.

After these excursions the car needed some urgent repairs, so we continued our travels by air, and the car was sold in Lima some weeks later. The Agricultural Experiment Station in Piura kindly supplied us with a car to make an excursion to Ayabaca in the northern Peruvian Andes, where we hoped to find species of the little known series Piurana; we found at least two species, including S. piruae. The expedition was concluded with a short trip from Quito in a southerly direction, and in the surroundings of Guayaquil. On 17 May we embarked at Guayaquil, where we joined our luggage which Mr. Diers had put on board in Lima. Mr. Diers followed on 26 July by air.

While it is very interesting for a foreigner to travel in the Andes, it should not be forgotten that living conditions for the inhabitants are hard because of extremes of climate, the isolated situation, and the long distances between centres of civilization. These countries are in no way favoured to develop by themselves and one has to acknowledge the endeavours made by people and government to improve their situation, especially in Bolivia and Peru where we made longer visits.

We would like to say that the officials and other people that we met in the Andes were always very helpful and friendly, and followed our undertaking with great interest.

The following material was brought back:-

	Number of collections
Solanum, wild species	282
Solanum, cultivated forms	550
Phaseolus vulgaris	150
Other Phaseolus species	48
Lupinus species	64
Lycopersicum, wild species	22
Capsicum, cultivated forms	30
Zea mays	56
Cereals	26
Other cultivated plants	52
Ornamentals and plants for chromosome geographic investigations	187
Orchids	40
Mr. Diers' collection	500
Sprout tip preparations of Mr. Diers	1,350

In conclusion, a word should be said about the maintenance of collections. The Max-Planck-Institut has had much experience for many decades in the culture of primitive and wild plant material. In many cases these plants come from regions with climatic conditions differing from those of Europe and it has been found extremely difficult to maintain a collection over long periods. Moreover, it is always difficult to obtain hybrids, and owing to natural climatic selection (including photoperiod) many forms become lost. If the potential value of an expedition is to be realized, prompt attention has to be given to the proper maintenance of collections, and the best way is undoubtedly to make suitable arrangements for this to be done in the regions where the species are native. Since the Andes represent one of the largest gene-centres for so many cultivated plants, we fully realize the importance of a station with similar objectives in the Andean region of South America and support the endeavours of Prof. Dr. Rudorf in this respect.

139. *A Preliminary report of the Botanical Mission of the University of Kyoto (B.M.U.K.) to the Eastern Mediterranean Countries, April-July 1959

K. Yamashita
Biological Laboratory, Kyoto University, Kyoto, Japan

With a Rockefeller research grant, the Kyoto University, Kyoto, Japan, organized the Botanical Mission to the Eastern Mediterranean countries, including Egypt (U.A.R.), Lebanon, Syria (U.A.R.), Jordan, Turkey, Greece and Italy, for the collection of mainly wheat and Aegilops materials for the studies on the origin of wheats.

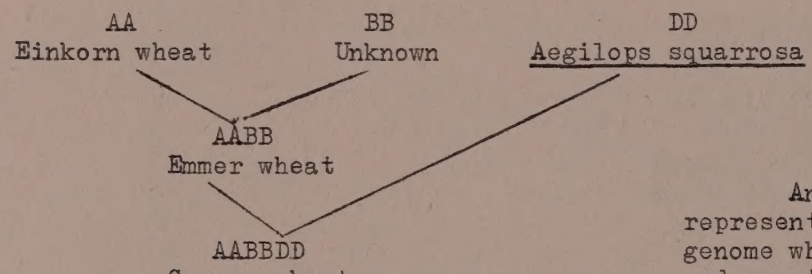
Members

Dr. Kosuke Yamashita, Professor of Biology, Kyoto University (Leader)
Mr. Masatake Tanaka, Assistant Professor of Genetics, Kyoto University
Dr. Osamu Suzuka, Lecturer of Cytogenetics, Kyoto University
Mr. Seiji Nakamura, a cameraman of the Nichiei Co. Ltd., Tokyo

Proposed project

A proposed project is referred to in Wheat Information Service No.8, as follows:

"According to the cytological and genetical studies of Dr. H. Kihara, the former Professor of Genetics, Kyoto University, Japan, it is known that the genealogical relationship of wheats and their relatives is as follows:



Annotation: A, B or D represents the symbol of the genome which is the cytological and genetical unit of making up each species.

DD-species has already been found to be Aegilops squarrosa, a wild growing species from Pakistan to Iran through Afghanistan, and it is thought that our common wheat, AABBDD, occurred by the hybridization between Emmer wheat and Aegilops squarrosa in those regions.

Similarly, it is presumed that Emmer wheat was originated by the crossing between Einkorn wheat, an existing diploid wheat species, and a certain unknown species with BB constitution. By recent studies, however, it is thought that BB-species can be the species of the Section Sitopsis of the genus Aegilops. It is also known that the species of Aegilops are distributed in the Eastern Mediterranean countries.

In this connection, K. Yamashita, and his colleagues are specially interested in the botanical exploration in the Eastern Mediterranean countries.

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* This was referred to in Newsletter item No.88.
Wheat Information Service Nos. 9-10, December 1959.

They are also interested in other wild growing plant species as well as cultivated plants."

Itinerary

The members left Tokyo for Cairo in the middle of April and returned home in the middle of July from Istanbul, as follows:-

The writer wishes to express his appreciation to the officials and people in those countries mentioned above who kindly afforded the Mission with their facilities.

Abbreviations - Y: K.Yamashita; S: O.Suzuka; T: M.Tanaka;
N: S.Nakamura.
(a): by air; (j): by jeep; (c): by car; (t) by train;
(b): by bus; (s): by ship

Y, T, S, N

April 13 (M) Tokyo (Japan) --(a)--
15 (W) --> Cairo (U.A.R.)

		Y, T	S, N
19	(Su)		Cairo--(a)-->Luxor
21	(Tu)	Cairo--(j)--> Alexandria	
22	(W)	Alexandria--(j)-->Matruh	
23	(Th)	Matruh	Luxor
		(j) ----> Cairo	<--- (t)
		Y, T, S	N
25	(Sa)	Cairo--(j)--> Suez	Cairo
26	(Su)	Suez--(j)--> Ismailia--(j)-->Cairo	:
		Y, T, S, N	
28	(Tu)	Cairo--(j)-->Alexandria	
29	(W)	Alexandria--(s)--	
30	(Th)	-->Beirut (Lebanon)	
May 1	(F)	Excursion to Saida and Biblos (j)	
		Y, T, S	N
3	(Su)	Beirut--(j)-->Baalbek	Beirut
4	(M)	Baalbek--(j)-->Beirut	Excursion to Biblos (c)
		Y, T, S, N	
6	(W)	Beirut--(j)--> Damascus (U.A.R.)	
7	(Th)	Excursion to Mt. Hermon (j)	
8	(F)	Excursion to Soueida (j)	
10	(Su)	Damascus--(j)--> Amman (Jordan)	
11	(M)	Damascus--(j)--> Dead Sea	
12	(Tu)	Dead Sea--(j)-->Jerusalem	
13	(W)	Excursion to Bethlehem and Hebron (j), Jerusalem--(j)--> Dead Sea	
14	(Th)	Excursion to the north of Jerico (j), Dead Sea--(j)-- Amman	
15	(F)	Amman--(j)--> Damascus (U.A.R.)	

			Y	T, S, N
May	16	(Sa)	Damascus--(a)-->Kemshly	
	17	(Su)	Kemshly	Damascus
			(a)---->Aleppo<----(j)	
			Y, T, S, N	
	18	(M)	Aleppo--(j)--> Adana (Turkey)	
	19	(Tu)	Adana--(j)-->Ankara	
			Y, T, S	N
	24	(Su)	Ankara--(a)--> Rome (Italy)	Ankara--(t)--
	25	(M)		-->Istanbul
	26	(Tu)	Rome--(c)--> Naples	:
	27	(W)	Excursion to Pompei (c), Naples--(c)--> Rome	
	28	(Th)	Rome--(a)--> Palermo	Istanbul--(a)--> Athens
	29	(F)	Palermo--(t)--> Agrigento	:
	30	(Sa)	Agrigento--(t)-->Catania	
	31	(Su)	Catania--(a)--> Rome	
			Y	T, S
			Rome--(a)-->Milano	Rome
June	1	(M)	Milano--(b)--> Pavia	:
	2	(Tu)	Excursion to St. Angelo (c), Pavia--(b)--> Milano, Milano--(a)-->Rome	
			Y, T, S	
	3	(W)	Rome--(a)-->Athens (Greece)	

			Y	T	S
June	5	(F)	Athens--(a)-->Istanbul (Turkey)		
	6	(Sa)	Istanbul--(a)-->Ankara	Athens--(t)-->Olympia	Athens--(a)-->Chania
	7	(Su)	Excursion to Ankara Baraij(j)	Excursion around Olympia	Chania--(b)-->Iraklion Excursion to Erini
	8	(M)	Wheat and Barley Breeders' Meeting (F.A.O.)	Olympia--(b)-->Tripolis	Excursion to Knossos, Iraklion--(a)--> Athens
	9	(Tu)	Visit Ankara Univ.	Excursion around Tripolis	Athens
	10	(W)	Excursion to the south of Ankara(j)	Tripolis--(b)--> Athens	Athens--(t)--> Larissa
	11	(Th)	Excursion to Beypazan (j)	Athens--(a)-->Ankara	Excursion to Volos and Portaria

		Y, T	S
June 12	(F)		Larissa--(t)--> Thessaloniki, Excursion to Vasilika
13	(Sa)	Excursion to Ayas (j)	
14	(Su)		Excursion to Lachanas
15	(M)	Ankara--(j)-->Bursa	Thessaloniki--(t)--> Sarrai
16	(Tu)	Bursa--(j)--> Bandirma	Sarrai--(t)--> Istanbul (Turkey)
17	(W)	Excursion to Gönen (j), Bandirma--(s)--> Istanbul	Hyderpasa --(t)-->
18	(Th)	Istanbul--(j)-->Bolu	Ankara
19	(F)	Bolu--(j)--> Ankara	Ankara--(t)--> Kayseri
20	(Sa)	Excursion around Ankara (j)	Excursion to Mt. Ali
21	(Su)	Ankara--(j)-->Corum	" " Erkilet
22	(M)	Corum--(j)-->Samsun (Nakamura returned to Ankara)	" " Upper Talas
23	(Tu)	Samsun--(j)--> Amasya	" " Urgüp and Göreme
24	(W)	Amasya--(j)--> Yozgat	Kayseri--(t)--> Konya
25	(Th)	Yozgat--(j)--> Ankara	Konya--(b)--> Akseki
		Y, T, N	
26		Ankara-- (a) --> Agri	Akseki-- (b) --> Antalya
27	(Sa)	Excursion to Dogbayazit (c)	Antalya-- (b) --> Afyon
28	(Su)	Agri-- (b) --> Erzurum	Excursion around Afyon
			Afyon-- (t) --> Denizli
29	(M)	Erzurum-- (a) --> Ankara	Excursion to Pamukkale and Denizli
			Denizli-- (b) --> Izmir, Excursion to Bergama
July 1	(W)		Excursion to Ephesos
2	(Th)	Excursion to Ayas (j)	
3	(F)	Excursion to Ayas (j)	Izmir--(t)--> Ankara
4	(Sa)	Excursion to the south of Ankara (j)	
		Y, T, S, N	
5	(Su)	Excursion to the north east of Ankara (j)	
6	(M)	Ankara--(j)-->Adapazari	
7	(Tu)	Adapazari--(j)--> Istanbul	
9	(W)	Visit Agr. Exp. Station in Yesilköy (j)	
		Y	T, S, N
12	(Su)	Istanbul--(a)--	
13	(M)	--> Teheran (Iran)	
14	(Tu)	Teheran--(a)-->Kabul (Afghanistan)	Istanbul ..(a).. Tokyo (Japan)
16	(Th)	Excursion to Sorobi (c)	
17	(F)	Kabul--(a)--> New Delhi (India)	
18	(Sa)	New Delhi \ (a)	
19	(Su)	\-->Tokyo (Japan)	

Collections

Table 1. Number of strains of wheats and their relatives collected

Country	Triticum	Aegilops	Haynaldia	Agropyron	Secale	Hordeum	Avena
Egypt	38	56	-	-	-	7	7
Jordan	16	140	-	-	-	3	4
Lebanon	5	32	-	-	1	2	2
Syria	29	90	-	-	2	6	3
Turkey	201	620	-	12	37	10	13
Greece	19	216	5	-	5	1	7
Italy	9	29	6	-	2	-	8
Total	317	1,183	11	12	47	29	44

Total: 1,643 strains from 390 habitats.

Table 2. Number of strains of Secale and Hordeum collected

	Wild type	Cultivated type	Total
Secale	14	33	47(31)
Hordeum	12	17	29(24)

Number of habitats is given in brackets.

Table 3. Number of strains and habitats of Triticum collected

Country	Einkorn		Emmer		Dinkel
	Wild type	Cultivated type	Wild type	Cultivated type	Cultivated type
Egypt	-	-	-	8(3)	30(11)
Jordan	-	-	1(1)	15(5)	-
Lebanon	-	-	-	4(3)	1(1)
Syria	1(1)	-	2(2)	12(9)	14(5)
Turkey	47(23)	9(6)	-	54(49)	91(35)
Greece	7(1)	-	-	3(2)	9(2)
Italy	-	-	-	6(3)	3(1)
Total	55(25)	9(6)	3(3)	102(74)	148(55)

Number of habitats is given in brackets.
Total number of strains is 317.

Table 4. Number of strains and habitats of Aegilops collected

Species	Egypt	Jordan	Lebanon	Syria	Turkey	Greece	Italy	Total
Ae.umbellulata	-	1(1)	-	2(1)	72(44)	-	-	75(46)
ovata	-	9(8)	7(4)	19(13)	51(30)	8(4)	22(12)	116(71)
triaristata	-	-	-	-	69(44)	52(9)	6(4)	127(57)
biuncialis	-	-	6(2)	7(4)	97(44)	1(1)	-	111(51)
columnaris	-	-	-	-	6(3)	-	-	6(3)
variabilis (incl. Ae.Kotschyi)	28(15)	119(30)	7(6)	12(8)	8(4)	41(9)	1(1)	216(73)
triuncialis	-	-	9(5)	10(9)	166(100)	54(11)	-	239(125)
caudata	-	-	-	3(1)	30(26)	39(9)	-	72(36)
cylindrica	-	-	-	1(1)	28(22)	-	-	29(23)
Heldreichii	-	-	-	-	6(2)	20(7)	-	26(9)
uniaristata	-	-	-	-	-	1(1)	-	1(1)
mutica	-	-	-	-	65(20)	-	-	65(20)
speltoides	-	-	-	13(7)	7(4)	-	-	20(11)
Aucheri	-	-	-	15(8)	12(6)	-	-	27(14)
longissima	-	9(7)	2(2)	7(5)	-	-	-	18(14)
bicornis	27(6)	-	-	-	-	-	-	27(6)
crassa	-	2(2)	1(1)	1(1)	-	-	-	4(4)
ventricosa	1(1)	-	-	-	-	-	-	1(1)
Natural hybrids	-	-	-	-	3(3)	-	-	3(3)
Total	56	140	32	90	620	216	29	1,183(313)

Number of habitats is given in brackets.

140. FAO: Crop Production and Improvement Branch - Activities in seed exchange March/August 1960

Country and date of receipt of requests	Seed requested	Date dealt with and remarks
GUATEMALA Mr. Jean Pourtauborde 2/3/60	Seed of Trifolium alexandrinum T. incarnatum T. pratense Medicago sativa (var. Tadla, Morocco) M. sativa (var. Provence) Lotus corniculatus for use in irrigation trials	Seed of requested species sent from headquarters 10/3/60
INDIA (Assam) Tocklai Experiment Station 3/3/60	Seed of leguminous tree species Tolnifera peruifera "balsamo" Hymenaea stilbocarpa satobá da marta Peltophorum dubium (P. vogelianum)	Seed requested from Brazil 6/3/60; received and despatched 31/3/60
SYRIA (U.A.R.) Mr. C.C. Eidt 8/3/60	5 kg. seed samples of Zea mays Sorghum vulgare Helianthus annus	Seed requested from Canada 9/3/60; received and despatched 21/6/60
U.S.A. (University of California) Dr. V.B. Younger 8/3/60	Seed or planting material of Poa jemtlandica P. bulbosa viviporous and normal P. alpina P. supina P. artica Festuca ovina F. ovina var. vivipara Deschampsia caespitosa D. alpina Cynosurus cristata	Material requested from Royal Botanic Garden, Kew, 21/3/60 Received and despatched 20/4/60 Seed of Deschampsia caespitosa D. alpina Cynosurus cristata and Festuca ovina planting material of Poa bulbosa and P. supina available
NORTHERN NIGERIA Mr. D.L. Curtis 18/3/60	Seed of Triticum durum from North Africa	Seed requested from Rabat, Morocco, 24/3/60 Seed of following varieties rec'd and desp. 28/4/60: 54 - Beni Ayatt, Morocco 088 - Ouled ben Darud " 0181 - Ouled Youssef " 0258 - Trikia " 0327 - Quedmiona " 0432 - Grifla " 01154 - Dridria " 2255 - Agreboze, Tunisia 2648 - Sindyouk " 2909 - Oued Zenabi, Algeria

Country and date of receipt of requests	Seed requested	Date dealt with and remarks
IRAN Dr. A.M. Mustafa 18/3/60	Seed of various kinds of Ricinus communis and Arachis hypagaea	Castor seed requested from Brazil and groundnut seed from Sudan. 6/4/60. Still awaiting seed which is being sent.
+ EGYPT (U.A.R.) Mr. G.J. Piquer 25/3/60	15 kg. of seed of Bitter Almond Primus amygdalus var. amara for Ministry of Agriculture, Aden	Requested from Italy and Israel 25/3/60. Endeavouring to obtain seed but does not appear to be available.
ITALY Prof. G.U. Papi 30/3/60	Seed of Helianthus annus	Seed requested from U.S.A. and Canada 13/4/60; received and despatched 23/6/60 from Canada seed of sunflower hybrids Advent and Admiral and of inbreds S-37-388, Sunrise, Cm 5 and CM 27'; from U.S.A. (Texas) seed of several self-fertile sunflower lines.
BRAZIL Recife Mr. R.E. Pioger 1/4/60	Seed of Cyamopsis tetraganoloba	Seed requested from India 8/4/60; rec'd and desp. 31/5/60
PERU Mr. Pompeyo Contreras, Lamayeque Exp. Station 4/4/60	Seed of rice varieties: Bersani - Italy Taichung 65 - Taiwan Sigadis - Indonesia Leung Cho Kan - Hong Kong	Seed requested 8/4/60. Seed from Italy rec'd and despatched 12/4/60. Still awaiting seed from Far East.
TUNISIA Dr. N.C. Keulemans 8/4/60	Seed of promising strains from Uniform Mediterranean Nurseries 1953-56:	Seed of following UMN Nos. available sent 6/5/60 from headquarters:

UMN No.			
503	Ehrharta calycina	Australia	2310
2310	" "	Unarlee strain Australia	2595
			1868
2594	" "	Cyprus 1-52-122	2131
2531	" "	V95 Australia	2056
2046	E. longiflora	1-51-87 Cyprus (Ex. Australia)	2301
			2522
2595	"	1-51-87 Cyprus	2604
1868	Trifolium fragiferum	California	
2521	" "	Palestine V71 Australia	
657	Phalaris tuberosa	709 Israel	
2131	" "	709 Israel	
621	" "	var. stenoptera Maroc	
505	" "	Victorian (Australia)	
2056	" "	var. stenoptera 1-50-24 Cyprus	

Country and date of receipt of requests	Seed requested	Date dealt with and remarks
TUNISIA (continued)	UMN No. 2301 Phalaris tuberosa Israel M 169 2312 " " Australia 2522 " " Australia V24 2602 " " Cyprus 1-53-164	
BURMA, Rangoon Dr. W.B. Osborne 8/4/60	Seed of following pasture species requested: Brachiaria brizantha Cenchrus ciliaris Chloris gayana Cynodon plectostachyus Digitaria eriantha D. smutsii Echinochloa pyramidalis Eragrostis curvula Hyparrhenia hirta H. rufa Ixophorus unisetus Panicum antidotale P. coloratum P. maximum Paspalum almum P. convexum P. dilatatum P. plicatulum P. scrobiculatum P. yaguaronense Setaria sphacelata Urochloa pullulans Trifolium semipilosum T. subterraneum	Seed of available species: Eragrostis curvula Panicum antidotale P. coloratum and Trifolium subterraneum sent from headquarters 6/4/60. Other species requested from Kenya.
KUWAIT Mr. Yahya Gannam 8/4/60	Seed of following forage species: Medicago sativa var. peruvian, Kansas Common, Buffalo Sorghum vulgare (var. Honey, Hegari, Local Durra, Red Bine) Avena sativa (var. Palestinian, Russian, Canadian) Agropyron elongatum Bromus inermis Cynodon dactylon Dactylis glomerata Festuca elatior F. arundinacea Eragrostis chloromelas E. curvula E. lehmanniana Lolium perenne Panicum antidotale Paspalum dilatatum Phalaris tuberosa Ph. tuberosa var. stenoptera	Seed of following species sent from headquarters 18/5/60: Medicago sativa var. Peruvian Sorghum vulgare var. Red Bine Bromus inermis Dactylis glomerata Festuca elatior F. arundinacea Lolium perenne Panicum antidotale and Phalaris tuberosa. Other species requested from U.S.A. Awaiting seed of Cenchrus ciliaris Chloris gayana

Country and date of receipt of requests	Seed requested	Date dealt with and remarks
KUWAIT (continued)	Lotus corniculatus Medicago hispida Trifolium repens T. repens var. giganteum T. hibridum Sanguisorba minor	Festuca arundinacea Lolium perenne Panicum antidotale and Phalaris tuberosa. Other species requested from U.S.A.
MADAGASCAR Mr. Pierre Bordier 14/4/60	Seed of Amaranthus caudatus	Requested from Italy. Received and despatched 19/5/60
BURMA Dr. W.B. Osborne 3/5/60	Seed of Sorghum vulgare for fodder production and ensilage suitable for growing in 30" rainfall area with restricted growing season.	Requested from India, New Delhi, 16/5/60. Seed to be forwarded direct from India. Sent 6/6/60
ITALY, Trento Prof. Luigi Zanotti 6/5/60	Seed of forage species required for intensive research in pasture improvement in the Alpine region: Medicago sativa M. falcata M. media Trifolium pratense (early and late varieties) T. repens varieties S100, Ultuna and Ulve Dactylis glomerata varieties S26, S37, S143 Alcala,29 (Spain) Glasnevin, Germinal, Floréal, Mannersteg, Lembke, Dorise, Barenza D. glomerata Roskilde II hay Roskilde II late Phleum pratense varieties S48, S51 Melle, Maintenon, Øtofte A III, C.B., Heislemp Lolium perenne varieties S23, S24, Melle Trianon, Primavere L. italicum varieties Rina, Rita, Westerwoldicum, Oregon Festuca pratensis varieties Melle, S53, S215, Steinacher, Sena, Fepra, Kentucky, Hooitype C.B. Poa pratensis ecotypes 2n = 18, 2n = 40, 2n = 48 Trisetum flavescens Bromus erectus B. mollis	Majority of seeds requested 15/4/60 and received by 30/5/60

Country and date of receipt of requests	Seed requested	Date dealt with and remarks
ITALY (continued)	Alopecurus pratensis A. borealis A. pseudo-brachystachyus A.alpinus A.agrestis Holcus mollis Festuca rubra F. arundinacea	
WALES (Aberystwyth) Welsh Plant Breeding Station 27/5/60	Seed of Festuca elatior from Portugal, Mediterranean and North Africa	Seed of Festuca elatior var. arundinacea from Tunisia received and dispatched 7/6/60
EGYPT (U.A.R.) Mr. G.J.Piquer 1/6/60	Seed of following citrus material: Trifoliate orange Rangpur lime Mexican lime Troyer citrange Morton citrange from the following countries: U.S.A. (California and Florida) Brazil, Argentina, Mexico, Spain, South Africa, Australia and Taiwan.	Majority of seed requested by 6/6/60 so far, seed received from Argentina, Brazil and South Africa
NEW ZEALAND, (Canterbury) Lincoln College Professor R. Langer 10/6/60	Seed of Festuca elatior and Dactylis maritima suitable for region with 25" rainfall and high evaporation rate of 36 inches.	Seed of Festuca elatior from Tunisia received and dispatched 21/6/60 awaiting seed of Dactylis maritima from U.S.A.
SENEGAL St. Louis Mr. J. Dubois 6/6/60	Seed of Pennisetum orientale Saccharum spontaneum Atriplex semi-baccata A. halimus and Kochia trichopylla	Seed of Pennisetum orientale Atriplex semi-baccata and Kochia trichopylla sent from headquarters 9/6/60
+ U.S.A. (New York) Dr. H.N. Fleischer 6/6/60	Seed of Anagyris foetida for medical research	Requested seed from Tunisia and Morocco 8/6/60. No reply as yet.
+ CANADA (Saskatoon) Dr. B.P. Goplen 13/6/60	Melilotus bicolor (Boiss and Bal) enderiné in the region of the Sea of Marmora, Turkey	Requested seed from Turkey. No reply as yet.

Country and date of receipt of request	Seed requested	Date dealt with and remarks
NETHERLANDS Dr. M.J. Zijp 15/6/60	Seed of Festuca arundinacea Dactylis glomerata and Festuca elatior from Tunisia	Seed of Festuca elatior var. arundinacea and Dactylis glomerata sent from headquarters 21/6/60
AFGHANISTAN Mr. A.W. Mackenzie 16/6/60	Substantial quantity of Triticum vulgare var. 'Yilufen' from Chile to be received before October 1960	Requested from Banco del Estado, Chile, 20/6/60 will be sent in due course.
NETHERLANDS, Wageningen Dr. G.E. van Dijk 20/6/60	Seed of Lolium spp. Festuca arundinacea F. pratensis, Dactylis glomerata and Trifolium spp. from wide selection of countries.	Seed of the following species sent on 30/6/60:- Festuca elatior var. arundinacea FAO No. 2899 Elvas, Portugal " " 2124 Selection Ex. Oregon, U.S.A. " " 2465 CRA Rabat, Morocco " " 2304 M171, Israel " " 2076 (261), Spain, Madrid " " 2663(261), Spain, Madrid " " 4967, 1-53-632 Israel " " 1878, K31, U.S.A. " " 1916 Portugal " " 1863 Rabat, Morocco " " 8624 Tunisia Festuca elatior FAO No. 4966 Israel Dactylis glomerata FAO No. 2641, Padova, Italy " " 2045, 1-52-518 Turkey " " 2160, 641, Madrid, Spain " " 2662, 641, Madrid Spain " " 1914 Portugal " " 2340 SRF 152/0 Morocco " " 2416 Rabat 1955 " " 2524 Gippsland U85 Australia " " 2088 BC 656 N. 2 Certified Pedigree " " 2582 Grassland Strain No. 2 Certified BC 656 " " 2183 Early Group Selection INRA Montpellier

Country and date of receipt of requests	Seed requested	Date dealt with and remarks
NETHERLANDS (continued)		FAO No. 4417 "Adraifen" Chile " " 5709 Lebanon " " HP 57 No. 16 " " 5710 Lebanon HP 57 No. 17 " " 5711 Lebanon HP 57 No. 19 Lolium perenne FAO No. 2534 Clunes U99 Australia " " 2535 Kyneton V100 Australia " " 2640 Sgaravatti Padova, Italy " " 2664 (244), Madrid, Spain " " 2860 Clunes special (low rainfall type) Melbourne, Australia. " " 2846 Sgaravatti Italy All seed sent from headquarters 30/6/60
+ FRANCE Mr. J.M. Jouannic 23/6/60	Seed of the following:- Vicia spp:- V. articulata V. atropurpurea V. aurentia V. bithynica V. calcarata V. cassubica V. dasycarpa V. disperma V. dumetorum V. erviformis V. ervilla V. gracilis V. grandiflora V. hirsuta V. lutea V. monantha V. musquinea V. narbonensis V. pieta V. pseudo-orobus V. pseudo-cracca V. pyrenaica V. sepium V. serratifolia V. sicula V. syvatica V. tetrasperma	Seed of the following Vicia spp. sent from headquarters 8/7/60:- V. articulata V. atropurpurea V. dasycarpa V. ervilla V. grandiflora V. narbonensis V. sepium Requested other species from Royal Botanic Gardens, Kew 7/7/60. These were available and are being sent.

Country and date of receipt of request	Seed requested	Date dealt with and remarks
+ ISRAEL Mr. J. Katznelson Nve-Yaar Experiment Station 25/6/60	Seed of unthreshed (unhulled) Trifolium subterraneum from Spain, Tunisia, Morocco, Italy, Syria, Turkey, Iran, Iraq, also seed of the following Trifolium spp: T. eriosphoerum T. pilulare T. ridificum T. globosum from a wide range of natural habitats in Mediterranean region. Seed required for taxanomic studies.	Seed of all species requested by 19/7/60. So far unhulled seed of Trifolium subterraneum received from Morocco.
+ ISRAEL Mr. Arich Abraham Agricultural Research Station Bet Dagan 25/6/60	Seed of Trifolium somalense	Requested seed from Royal Botanic Gardens, Kew, 7/7/60. None available.
ITALY Professor G.U. Papi 28/6/60	Seed of Glycine soya varieties PI-54619-5-1 Hawkeye	Requested seed from the U.S.A. 26/7/60
EGYPT (U.A.R.) Mr. G.J. Piquer 30/6/60	Seed of cantaloupe - Super Banana and Pommodore - Gioia della Mensa from Italy, Okra (Hibiscus esculentus) from Greece or Turkey and seed of Lycopersicon esculentum, resistant to nematodes, from Florida and Hawaii.	Seed of all species requested by 7/7/60. So far cantaloupe and pommodore received from Italy and seed of nematode resistane lines from Hawaii
FRANCE Plessis-Belleville Mr. Barres 6/7/60	Seed of varieties of flax (Linum usitatissimum) the following:- Minerva, Sheyenne, U.S.A. Taboré, Uruguay Royal, Canada CI 687 R 54 Géant de Kostroma Roland L1120) Severianine) Russian Litowaki 230) T.5)	Seed requested from Netherlands Flax Institute 15/7/60

Country and date of receipt of requests	Seed requested	Date dealt with and remarks
TANGANYIKA, Department of Agriculture Mr. D.J. Turner 12/7/60	8,000 lbs. of seed of Kenaf (Hibiscus cannabinus) of one of two Sudanese types ECR 985 and ECR 986 - seed in short supply in Sudan	Information requested from U.S.A. and South Africa on similar varieties and seed supply 19/7/60
IRAN Mr. R. Goddard-Wilson 18/7/60	Seed of Agropyron cristatum A. smithii A. trachycaulum Bromus inermis for use in range management in the arid and semi-arid regions near the Afghan border.	Seed of Agropyron cristatum and Bromus inermis sent 27/7/60. Address given of seed firm in Canada, where seed of all the species can be obtained in quantity.
ERITREA Mr. H.V. Stranger-Ford 29/7/60	Seed of Kenaf (Hibiscus cannabinus)	Requested seed to be sent from South Africa 8/8/60
AUSTRALIA Mr. J.R. McWilliam C.S.I.R.O., Canberra 12/8/60	Seed of ecotypes of Phalaris arundinacea for breeding work.	Seed requested from Spain, Portugal, France, Switzerland, United Kingdom, Jugoslavia, Greece, Italy, Holland and Russia. 19/8/60

All enquiries relating to seed should be addressed to Mr. M.D. Kernick, Crop Production and Improvement Branch, FAO, Rome, who would also be particularly interested to receive seed samples of the species mentioned in the seed requests marked "+".

141. United Kingdom: The history and improvement of cotton

(Review by D. Lewis in Heredity, London, Vol.14, Parts 3 and 4, p.449, May 1960)

The Application of Genetics to Cotton Improvement
by
Sir Joseph Hutchinson
(Cambridge University Press in association with the Empire Cotton Growing Corporation: London, 1959, viii + 86 pp. 15s.)

Thanks to the wise policy of the Empire Cotton Growing Corporation the cotton plant is a classical example in plant genetics and plant physiology. It is also a plant which has been greatly improved by breeding. Over the last half century, the cultivated cotton plant has been transformed from a perennial to an annual, has had its seed hair increased from one inch to two inches in length, and has become world-wide in its cultivation. A genus with diploid species and primitive cultivated types in Africa and India and allopolyploid species and modern cultivated types in America is full of interesting problems to genetics and plant breeding. Sir Joseph Hutchinson has surveyed the history, taxonomy, origin, genetics and improvement in cotton. The emphasis of the survey is on the application of genetics to cotton breeding. It does not set out to be an exhaustive review or a source book for cotton breeders, but attempts to draw certain conclusions from the intensive study of the genetics of cotton.

The study of wild populations has revealed that cotton does not conform to Vavilov's theory of decreasing variation away from the centre of origin. The greatest variation in cotton is not in the centres of origin. Hutchinson relates this difference to the type of breeding system. When a species has spread, and at the same time has adopted an inbreeding system, then its greatest diversity is at the centre. When a species spreads and retains its outbreeding system, it retains its variation at the periphery.

The study of gene substitution is discussed from the excellent example of Knight's work on Black Arm Resistance. The transfer of a single gene for resistance from Gossypium hirsutum to G. barbadense has resulted in good resistant cultivated varieties. But these varieties are not as good as those lacking the foreign gene except under conditions of bad disease epidemics, which under good cultivation do not often exist. The moral is that one gene or at most a small chromosome segment is not without its ancillary effects and makes this promising method of plant improvement less attractive than it appeared on theoretical grounds.

The crucial problem of the breeder is the type of breeding system to adopt; this is discussed at some length. Is it better to maintain genetic heterogeneity and preserve the possibility of later improvement or to aim at purity and future stagnation? Our knowledge of the merits of long-term breeding policies is scanty, so that all concerned in plant and animal improvement should profit by the cotton experiments.

142. United Kingdom: The history and improvement of cotton

Another review of Sir Joseph Hutchinson's book entitled

"The Application of Genetics to Cotton Improvement"

by J.W.P. in Tropical Agriculture, Trinidad, Vol.37, No.3, pp.245-8, July 1960.

This lucid and stimulating book is based on lectures delivered by Sir Joseph Hutchinson at North Carolina State College in 1954, together with more recent material from the work in progress at Namulonge.

As stated on the dust cover 'Sir Joseph reviews the range of the genus Gossypium and the place in it of the four species which constitute the cotton of commerce. He traces the historical development of these species, in both the Old and the New Worlds, from the coarse, short perennials grown over 4,000 years ago to the very fine, long-fibred annuals of today.' He describes the development of strains resistant to the jassid pest and to bacterial blight and other diseases, by hybridization of races from different parts of the world. Breeding techniques are discussed in the light of recent work in Africa and the prospects for future development assessed ... This survey will be of interest to geneticists and plant physiologists generally, as well as to those who have a particular concern with cotton.' I would go further and say that the book should be of interest to all tropical agriculturists and botanists. Workers in temperate countries could derive benefit from it and it will provide them with food for thought.

On the question of nomenclature, Prokhanov (1959) considers that the correct name of Gossypium barbadense L. is G. peruvianum Cav., as Linnaeus's type specimen grown at Uppsala was G. arboreum L. Thus G. barbadense becomes a synonym for G. arboreum and the oldest legitimate name for the Sea Island cottons is then G. peruvianum Cav.

I find it difficult to accept Sir Joseph's hypothesis that the diploid G. herbaceum, which is only truly wild in southern Africa, was taken by man across the Pacific to northwestern Peru at least 4,500 years ago, where it was grown and crossed with the wild, lintless, diploid G. raimondii, giving rise to the allopolyploid G. peruvianum. Fragments of fishing net, line and fabric made of cotton have been found in excavations at Huaca Prieta in north Peru on a site occupied by people who were primarily fisher folk, but who practised a primitive agriculture from the earliest times. Cotton seeds, dated 2,400 B.C., found in the midden can be assigned to G. peruvianum with some degree of confidence and Sir Joseph says: 'there is nothing to suggest the presence of an Asiatic cotton' (the italics are mine). The technique of making twine was fairly good, but that of textile manufacture was very poor and 'textile making tools were extremely primitive or absent'. No mention is made in the book under review of the spinning instruments found in desert graves in pre-Inca Peru where 'an ancient civilization was located which used cotton as its basic textile and spun and wove it with instruments that differed in no essential particular from those used in Asia', an argument used by Hutchinson et al. (1947) in support of their hypothesis at that time.

The cytogenetical evidence of the origin of the New World cottons appears to be beyond doubt; it is the way in which the parent species were brought together that I question.

Apart from the difficulties of a trans-Pacific crossing by man at this early date, it is even more surprising that these early voyagers do not seem to have taken any food crops with them, as none of the food crops grown at Huaca Prieta are of Old World origin. In fact, the only crops common to the Old and New Worlds prior to 1492 were the common gourd (Lagenaria siceraria), sweet potato and coconut. Lagenaria still presents a problem, but, since it floats, it could have been distributed by sea. Although the sweet potato is usually considered to have originated in tropical America, this is not necessarily the case. Some authorities consider that it originated in tropical Africa. However, the cultigen is thought to have been derived from the wild species Ipomoea tiliacea, which is tuberous rooted and is widespread in tropical America, west tropical Africa and from eastern Malaysia to New Guinea. Thus I. batatas could have been developed independently in several regions and then been taken later by the Maoris to New Zealand in pre-Columbian days. Coconuts were discovered by the Spaniards growing on the west coast of Panama, but they cannot have been there very long, otherwise one would expect that they would have been taken over the narrow isthmus and become established on the Atlantic coast prior to Columbus. As Merrill (1954) points out, there are 1,800 or more cultivated species which were not common to both hemispheres until after 1492. This provides a cogent argument against many of the diffusionist theories put forward by several authorities, such as Heyerdahl and Sauer, as well as Sir Joseph's hypothesis of the origin of the New World cottons.

A further difficulty is that only seeds of G. peruvianum were found in the excavation of the Huaca Prieta midden (p.27). If these fishermen had taken G. herbaceum with them and grown it, when it then crossed with G. raimondii, I should have expected seeds or remains of G. herbaceum to have been found in the oldest part of the midden. Furthermore, the Old World cottons have not been found wild nor commensal with man in Peru or elsewhere in the New World.

G. tomentosum, a New World linted cotton which is wild and endemic in Hawaii, also presents a difficult problem. Sir Joseph considers that it originated from the same polyploidy as G. peruvianum. Thus it must have been taken by man in the reverse direction across the Pacific. The rapid rate of differentiation of the cultivated cottons is due to the influence of man. G. tomentosum does not have this advantage, as it has not been domesticated, has a very limited distribution and no other species of Gossypium are found near it. Thus it is difficult to believe that this species could have become so differentiated in the time postulated, as was also doubted by Mangelsdorf and Oliver (1951).

Stebbins (1950 and 1959) has postulated that G. herbaceum crossed over the Siberian-Alaskan land bridge in Tertiary times, with subsequent hybridization and amphiploidy in northern America, followed by the extinction of G. herbaceum in northern America and Asia, and the survival of G. raimondii in its present southern refuge.

As has already been suggested by Merrill (1954), I think that a more logical explanation of the origin and spread of both the ancient, relict, lintless species of Gossypium and the early 'cultivated' cottons is via Antarctica, probably in Tertiary times, when this vast land area carried in places a sub-tropical flora, as is shown by the palaeobotanical records. It

is possible that G. herbaceum, in which the mutation for lint had occurred, G. raimondii, and their allopolyploid hybrid G. peruvianum could have been developed in Antarctica and then retreated northwards into the respective continents as glaciation advanced. If Merrill is correct in his belief 'that there are in the Pacific Islands certain floristic elements that reached these islands from ancient Antarctica', this would explain the present position of G. tomentosum. If the genus and species originated elsewhere, then Antarctica could provide the route by which they spread. There are a number of genera of plants in South America, South Africa and Australia which could also have been spread in this way.

In this connection is is of interest to record that Darwin (quoted by Seward, 1931) wrote to his friend Hooker 'there must have existed a Tertiary Antarctic continent from which various forms radiated to southern extremities of our present continents'. Skottsberg, quoted by Good (1953) states 'the disappearance of the Tertiary Antarctica flora during the ice ages is of fundamental importance and has been greatly underestimated by plant geographers. No catastrophe of such dimensions and of such consequences has ever befallen the Tertiary flora of the northern hemisphere'.

Sir Joseph considers that both the northern Polar and Antarctica routes are improbable, as they do not offer a frost-free desert route for the migration of cotton. However, I would have expected arid or semi-arid areas to have occurred in parts of Antarctica, as is the case with other large land masses, although I have no evidence to support this at present. On the palaeobotanical evidence and the existence of coal deposits, there must have been times when parts of Antarctica were free of frost.

Until further evidence is forthcoming only surmise is possible. The possibility of cotton originating in Wegener's original land mass, the species being separated as the continents drifted, should not be lost sight of, nor should Harland's (1939) theory of a trans-Pacific land bridge.

The problem of the origin and spread of the cultivated cottons is an intriguing one, but there is much in Sir Joseph's book besides this. Once again, a short book by Sir Joseph has stimulated me to write a very long review.

References

GOOD, R. (1953). The Geography of the Flowering Plants. 2nd ed. Longmans Green: London.

HARLAND, S.C. (1939). The Genetics of Cotton. Cape: London.

HUTCHINSON, J.B., SILOW, R.A. and STEPHENS, S.G. (1947). The Evolution of Gossypium and the Differentiation of the Cultivated Cottons. Oxford University Press: London.

MANGELSDORF, P.C. and OLIVER, D.L. (1951). 'Whence Came Maize to Asia?' Bot. Mus. Leafl. Harv. 14, 263-291.

MERRILL, E.D. (1954). The Botany of Cook's Voyages ... Chronica Botanica: Waltham, Mass.

PROKHANOV, Y. (1959). 'What is Gossypium barbadense Linnaeus?' Taxon. 8, 41-46.

SEWARD, A.C. (1931). Plant Life through the Ages, p.463. Cambridge University Press: London.

STEBBINS, G.L. (1950). Variation and Evolution in Plants. Columbia University Press: New York.

STEBBINS, G.L. (1959). In Vistas in Botany, pp.258-290. Pergamon: London.

143. United Kingdom: John Innes Horticultural Institution, Bayfordbury, Hertford, England

The following are extracts from the Fiftieth Annual Report for 1959 (reported by Mr. Simmonds, Department of Potato Genetics):-

Expedition to South America

Studies of cultivated diploid potatoes referred to in previous reports (1956, 1958) raised a number of problems connected with the geographical distribution of variability in morphology and S allele composition of diploid populations which could not be resolved with the materials available at Bayfordbury. With the aid of funds from The Rockefeller Foundation, The Royal Society, The Percy Sladen Memorial Fund and the Agricultural Research Council, Dr. Dodds and Dr. Paxman are currently carrying out a tour of the important areas of diploid cultivation from Colombia to Argentina. They are travelling in a Land Rover (specially fitted out by Mr. Fitter, the Institution's joiner) which was taken by sea to Maracaibo by Dr. Paxman, who left on 28 October. Dr. Dodds followed by air on 19 November and the expedition was due to leave Maracaibo for the interior of Colombia about the 27th. They expect to return in April 1960.

The Commonwealth Potato Collection

One hundred and forty-eight new collections were received during the year. Of these, seventy-seven were Bolivian cultivars sent by Dr. M. Cardenas, University of San Simon, Cochabamba, which proved to contain a most interesting range of diploids and polyploids. Following the principle adopted some years ago, a portion of the collection of andigena types was grown for renewal of seed stocks and the opportunity was taken to plant some 300 families in the field. This planting permitted some observations suggestive of geographical differentiation of tuber characters and yielded also two striking morphological mutant segregates - one a corky-skinned type, the other a fasciated mutant. We hope to pursue these investigations next year.

Mr. Marks has recorded the chromosome numbers of four species of Solanum that were previously uncounted. They are: 2n = 2x = 24 - S. michoacanum, S. brachistotrichum and S. clarum; 2n = 4x = 48 - S. agrimonifolium.

144. United Kingdom: University of Durham, Newcastle-upon-Tyne.

Mr. J.H.H. Holden, of the Department of Agricultural Botany, King's College, wishes to have seed of species of Avenae, particularly diploids, tetraploids and wild hexaploids for use in his research on that genus.

145. Germany: Studies on South American potatoes

Dr. H. Ross, of the Max-Planck-Institut, Köln-Vogelsang, has studied the relationship of the tuber-bearing species of Solanum to the plant geographical formations of South America. The tuber-forming species of Solanum in South America are investigated in relation to specific vegetation zones, and theories are put forward on the occurrence of resistance to disease, based on the relationship to individual vegetation zones, ecological conditions and individual pests and diseases. Species of the hygrophytic

mountain forests and mist forests may be expected to be resistant to Phytophthora, Alternaria, Synchytrium and Erwinia phytophthora; species of the mesophytic Valle and Sierra scrub may be resistant to vector-transmitted viruses; species of the xerophytic Valle and Sierra thorn-bush formations may be expected to be resistant to Streptomyces, Spongospora and nematodes. Drought resistance is most marked in species of the last group and frost resistance most marked in the moist, dry and thorn "puna".

The effects of pasturing and forest clearance have been greater than was formerly believed; these biotic factors have damaged certain formations and also the Solanum species they contain to a greater or less extent; in certain cases the effect has been favourable. The making of settlements, fields and roads creates habitats which suit Solanum species, most of which prefer open situations, are sensitive to intense shade and are weak competitors. There are no indications to suggest movement over great distances.

(ROSS, H. 1960. Uber die Zugehörigkeit der knollentragenden Solanum-Arten zu den pflanzengeographischen Formationen Südamerikas und damit verbundene Resistenzfragen. Zeitschrift für Pflanzenzüchtung, Band 43, Heft 3, pp.217-240)

146. Poland: Institute for Plant Improvement and Acclimatization, Warsaw.

We have recently received the Index Seminum 1960 (p.45).

147. U.S.S.R.: Publications of the Institute of Plant Industry, Leningrad

The following reprints have been received from Professor P.M. Zhukovsky:-

ZHUKOVSKY, P.M. 1958. The creative progress of Nikolai Ivanovitch Vavilov. Bot. Ž., Moskva (Bot.J.), Vol.43, pp.905-11. (Russian only)

ZHUKOVSKY, P.M. 1959. Inter-relation between host and parasite in their centres of origin and elsewhere. Vestn. Seljkoz. Nauk., No.6, pp.25-34 (English, German and French summaries)

ZHUKOVSKY, P.M. 1959. At the centres of origin of cultivated plants of Latin America. Bot.Ž., Moskva (Bot.J.), Vol. 44, pp.262-72 and 722-737 (Russian only)
(Plant Breeding Abstracts: 1959, Abstract No.3582 and
1960, Abstract No.223)

148. Sénégal: Institut Français d'Afrique Noire (Section de Botanique), B.P. 206, Dakar.

Index Seminum (reçu récemment). Les semences offerts dans l'Index Seminum sont adressées gratuitement comme échantillons scientifiques aux stations gouvernementales ou aux entreprises privées dont l'Institut reçoit les "Index Seminum" ou "Catalogues", et avec lesquelles il effectue des échanges.

Exécution des commandes. La faculté germinative des graines étant de courte durée dans les pays tropicaux et sa conservation étant difficile, les semences sont récoltées à la première époque de maturité après l'arrivée de

la commande et expédiées après quelques jours de séchage. Elles ont ainsi leur pouvoir germinatif au départ de Dakar. Un certain délai peut donc s'écouler entre la commande et la livraison. Les quantités envoyées sont celles qui sont nécessaires pour un essai normal d'introduction (25 grains au minimum).

Lieu de récolte. Toutes les semences sont recueillies aux environs de Dakar (espèces introduites ou spontanées).

Note sur le climat de la région de Dakar. Climat tropical à pluies d'été (en moyenne 575 m/m de juillet à octobre avec un minimum en 1913 de 308 m/m et un maximum de 960 m/m en 1887). Dakar est dans le domaine sahélo-soudanais, secteur littoral, tempéré par les alizés qui soufflent du nord de décembre à juin. L'Harmattan, ou vent d'est, sec et chaud se fait sentir quelques jours par an, vers mars à mai; puis la mousson du sud-ouest apparait en juin pour céder aux vents d'est ou aux alizés à partir de novembre. L'humidité atmosphérique est assez élevée toute l'année. Moyenne de 68,8 % avec des maxima de 91 % en aout-septembre et des minima de 51,8 % en avril-mai. La rosée est souvent abondante. L'insolation est élevée, 2728 heures par an (Abidjan, en forêt dense n'a que 1033 heures). La température moyenne de l'année est de 25 ° 74 et septembre est le mois le plus chaud avec une moyenne de 28 ° 04.

Influence du climat sur la végétation. Très peu de plantes sahariennes ou du nord du sahara peuvent se développer normalement à Dakar. L'été chaud et humide ne leur convient pas. Il y a quelques exceptions que la présence des alizés favorise, ou qui recherchent, dans leur région d'origine, des biotopes humides. De même, les plantes de la forêt tropico-équatoriale souffrent des vents chauds et secs de l'est ou de ceux très frais (pouvant descendre à 10°) du nord, qui semblent provoquer aux feuilles, les mêmes phénomènes que la gelée aux végétaux venant du sud. Quelques soins et la recherche de lieux protégés permettent cependant à la plupart des espèces tropicales et subtropicales de croître dans les jardins, et les collections exotiques sont variées.

Les sols. Après le climat, le sol est une cause importante d'échecs possibles dans l'introduction des végétaux. Quelques indications sont données dans le but d'aider le technicien. Elles sont les résultats d'observations effectuées dans la région de Dakar pour les espèces autochtones et celles introduites. Il est bien évident que ces renseignements ne sont pas absolus et n'ont une certaine valeur que localement. Suivant l'importance des soins données, un bon praticien peut faire croître dans des sols physiquement éloignés, des espèces qui, normalement ne s'y complaisent pas. Par exemple, l'Acacia seyal qui caractérise les sols argileux de l'ouest africain dans les domaines sahélien et soudanien, peut se développer dans des sables grossiers presque purs lorsqu'il s'agit de l'obtenir dans un arboretum arénicole. Il y viendra difficilement et s'y adapte mal. Il est donc mentionné dans la classe des sols argileux car il en est une essence typique. Beaucoup de végétaux ont été signalés comme "indifférents". Certains le sont vraiment, d'autres croîssent dans des sols légers ou compacts.

Comme ils viennent à Dakar dans les uns et les autres, l'Institut a estimé qu'ils sont assez plastiques pour pouvoir supporter des écarts de composition pas trop importante, aidés les premières années avec seulement quelques différences d'arrosages suivant les saisons et quelques soins élémentaires qui sont à la base des pratiques horticoles.

C'est le cas de la plupart des plantes introduites dans de nombreux pays très éloignés, qui ont une grande amplitude édaphique en plus de celle climatique.

Demandes de semences. Les demandes de semences doivent être adressées à Monsieur le Directeur de l'Institut Français d'Afrique Noire (Section de Botanique), B.P. 206, Dakar.

149. Israel: The origin of berseem (Trifolium alexandrinum L.)

The origin of the "berseem", Egyptian or Alexandrian clover (Trifolium alexandrinum L.), is one of the long-debated riddles in the history of cultivated plants. It has not been found wild in Egypt. Models or drawings by the ancient Egyptians have not been found, nor have seeds been found in the tombs of the Pharaos, a fact emphasized by Schweinfurth (cited after Fairchild).

Earlier authors have expressed the opinion that it was introduced into Egypt from Anterior Asia. Delile (1824) stated that in his day seeds were frequently imported into Egypt from Syria, "where this clover is cultivated and possibly grows wild". Boissier wrote in his "Diagnoses" (1856): "Cum Trifolium alexandrinum spontaneum ignotum sit, et in Aegypto nonnisi cultum occurrat, lubenter suspicarer Tr. constantinopolitanum eius typum spontaneum esse". T. constantinopolitanum Ser., a narrow-throated species, distinguished from Linné's T. alexandrinum also by glabrescent or short-pubescent calyces with narrow, awl-shaped teeth, grows wild in Turkey, Syria and the Lebanon, i.e. to the north-east of Egypt, but apparently is missing in Palestine, though it was reported by Bornmueller from Jaffa (1914) and by himself (1912) and Dinsmore (in Post and Dinsmore 1932) from Tabigha on the shore of the Sea of Galilee.

An origin still further to the north is assumed by Bobrov (1945), who described a new clover of his Section Hiantia of subgenus Lagopus from the north-western slopes of the Caucasus, under the name of T. apertum Bobr. He finds it so similar to the cultivated berseem of Egypt that it might be regarded as its ancestor. Since this species was found also on the Black Sea shore and further to the south, in Turkey, this would strengthen the hypothesis reported by Hegi (1923) and Becker-Dillingen (1922) on the authority of Reynier, that the Mameluks who came from the Caucasus (Georgia) introduced the "Egyptian" clover into Egypt in about the 12th century of our era.

Thus, while there seems to exist a far-reaching agreement regarding the origin of the Egyptian clover in Anterior Asia* whence also other cultivated crops, like wheat, reached Egypt, it seems more natural to look for the wild progenitor or nearest contemporaneous relative in the immediate neighbourhood of Egypt, rather than in distant countries. Our attention is thus drawn to Palestine, where the presence of T. alexandrinum L. had already been reported by Hasselquist (1756), though like many authors after him, he did not state whether the plant found by him was wild or cultivated.

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* Becker-Dillingen (1922), however, mentioned a rather vague and uncontrolled report, according to which the berseem was brought to Egypt from the Balkan Peninsula during the 6th century of our era.

The assertion of its occurrence as a wild species in Palestine was first made by Aaronsohn (1910), who wrote: "There are also good reasons for believing that berseem (T. alexandrinum) originated in Palestine, though we do not know definitely where it was first cultivated. But it grows wild there, as does also T. carmeli, from which it differs only in slight botanical characters.* Moreover, T. panormitanum and T. supinum, very closely related to T. alexandrinum, grow wild in Palestine. The fact that this whole group of closely related species grows wild in this region seems to indicate that they originated here". Aaronsohn added that Egyptian clover was not cultivated much by the natives of Palestine, the species being mainly "sown with barley in the autumn along the coast, where the rainfall is as low as 14 to 16 inches per annum". These notes imply that Aaronsohn knew of the cultivation of berseem by indigenous farmers in Palestine instead of by European colonists, mainly in the region of Gaza, where the rainfall corresponds to his indications. This centre of cultivation, however, might be interpreted not only as a primary, but also as a secondary one, arising in the not-too-distant past under Egyptian influence.

Aaronsohn's opinion was also accepted by Eig (cf. Zemach 1931). Eig (1934) points out that he had in the Herbarium of the Hebrew University a wild clover which comes very near to the Lebanese T. berytheum. He calls it T. judaicum ad interim. T. berytheum Boiss. et Blanche was united with T. alexandrinum as one of its wild growing varieties by Trabut (1910), and later on by Thiébaut (1936, 1940). Eig's insufficiently described T. judaicum could, therefore, be included in the range of T. alexandrinum L. as one of its wild growing types. Eig, however, preferred to attach it to T. berytheum, which he considered a species very closely related to T. alexandrinum, but to be kept separate. Eig, like Aaronsohn, died before he had been able to study the matter further.

The idea that T. berytheum is the wild form of the Egyptian clover was first clearly pronounced by the great French botanist, L. Trabut, who has introduced Egyptian clover into general use in Algeria. In a paper published in 1910, he says quite definitely, on p.2: "D'un autre côté, le T. berytheum Boiss. Diagnoses (T. supinum var. tuberculatum Boiss. Flora Orientalis) doit être rattaché comme variété au T. alexandrinum; il représente probablement la forme sauvage".

To settle the complicated problem of the origin of the Egyptian clover conclusively, a detailed critical investigation of the whole group of "open-mouthed" Lagopus clovers of the Near East was advocated by Bornmueller (1914), and particularly by Eig (1934), who wrote: "We consider an investigation of the polymorphism of T. alexandrinum as indispensible, especially in Syria and Palestine, as well as a detailed study of the wild growing representatives of the Maritima-group in these countries, especially T. berytheum and vavilovi". The present investigation is a step in this direction.

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* Zemach (1931) assumed that Aaronsohn expressed his opinion only on the authority of Boissier. This is wrong, since, as will be shown, Aaronsohn had collected in Palestine both wild and cultivated alexandrinum clover, as well as numerous specimens of T. carmeli, though he, as many other botanists, possibly did not arrive at a clear distinction between the two species.

Summary of recent investigations

While the origin of the Egyptian clover is still debated, Aaronsohn (1910) and Eig (1934) asserted that it grows wild in Palestine. Lack of clear definition and knowledge of the wild species related to Trifolium alexandrinum and of the variability of the cultivated species have frustrated previous efforts to settle the question definitely.

T. berytheum Boiss. et Blanche sensu lato, known from the coastal plain of the Lebanon, is shown to grow wild also behind the dunes of the Mediterranean Sea from the Lebanese boundary to the Philistaean Plain of Israel. It is a variety of T. alexandrinum, doubtfully distinguished from the Linnaean type species. Both vary considerably in their distinctive characters, forming a complex with intermediate properties.

Claims in favour of T. panormitanum, leucanthum, apertum, etc. are invalidated. T. carmeli Boiss. and T. vavilovi Eig, insufficiently defined by their authors, are described anew in detail. They are similar to T. alexandrinum, but less so than T. berytheum, which must be regarded as the main genetical source from which man developed T. alexandrinum by selection. Its ecological adaptation to heavy inundated soils strengthens this conclusion, first expressed by Trabut (1910) without evidence. Little studied wild races of T. alexandrinum seem to exist in the Upper Jordan Valley. They may also have contributed their share to the origin of the Egyptian clover.

While there is no reason to look for an extinct ancestor of this clover, its origin has been quite analogous to that of other clovers which are known to occur both as wild and cultivated races close to each other.

Bibliography

AARONSOHN, A. 1910. Agricultural and botanical explorations in Palestine, U.S.D.A. Bur. Pl. Ind. Bull., 180.

BECKER-DILLINGEN, G. 1922. Handbuch des Hülsenfruchterbaues und Futterbaues, Berlin.

BOBROV, E.G. 1945. Rod klever (The genus Trifolium L.), Flora of URSS, 2, 189-261 (in Russian).

BOISSIER, E. 1856. Diagnoses plantarum novarum praesertim orientalium, Ser. 2, No.2, Lipsiae.

BORNMUELLER, J. 1912. Zur Flora von Palästina, Ungar, bot. Bl., 11, 3-12.

BORNMUELLER, J. 1914. Zur Flora des Libanon und Antilibanon, Beih. bot. Cbl. 31, Abt. II, 117-208.

DELILE, A.R. 1824. Histoire des plantes cultivées en Egypte (Descriptions de l'Egypte, 2nd ed. 19) Paris.

EIG, A. 1934. Niekotoryie klevery iz gruppy Trifolium alexandrinum (Some clovers of the alexandrinum group), Bull. appl. Bot., Gen. and Pl. Breed., Leningrad, Ser. 7, No.1, 107 (in Russian).

HASSELQUIST, F. 1756. Flora palaestina, Upsala.

HEGI, G. 1923. Illustrierte Flora von Mittel-Europa (cf. vol. 4, 3), München.

POST, G.E. and DINSMORE, J.E. 1932. Flora of Syria, Palestine and Sinai, 2nd ed., vol. 1, Beirut.

THIEBAUT, J. 1936, 1940, Flore libano-syrienne, vol.2, Mém. Inst. Egypte, 40, Le Caire.
TRABUT, L. 1910. Le trèfle d'Alexandrie. Gouvt. gén. Algérie, Dir. Agr. Serv. bot. Bull. 48.
ZEMACH, S. 1931. Der alexandrinische Klee (Trifolium alexandrinum) in Palästina, Tropenpflanzer, 34, 315-373.

(OPPENHEIMER, H.R. 1959. The origin of the Egyptian clover with critical revision of some closely related species. Bull. Res. Counc. of Israel, Section D: Botany, Vol.7D, No.3-4, pp.202-221)

150. Taiwan: Joint Commission on Rural Reconstruction, Taipei

A list* of plant material available for international exchange is included in the Report on Crop and Seed Improvement in Free China presented to the Second Far East Seed Improvement Workshop held at Tokyo, Japan, and sponsored by the International Cooperation Administration of the United States Government. The list offers varieties of the following crops (number of varieties after each crop name):-

Maize - 4 inbred lines	
Jute	2
Groundnut	4
Ramie	1
Rice	24
Soybean	3
Sweet potato	6
Wheat	5
Papaya	2
Milk vetch	1
Tea	2
Broad bean	2
Cauliflower	2
Eggplant	1
Green pea	1
Pai-tsai	1
Tomato	1

* List No. FESIW-59/3

151. Australia: C.S.I.R.O., Division of Plant Industry, Canberra

The following has recently been received:-

Quarterly list of introductions No. 59 (Inventory of plants introduced during the quarter ended 31st December 1959)

This Quarterly List records the plants brought into Australia by the Plant Introduction Section of the C.S.I.R.O. Division of Plant Industry. In addition to the number and name of the plant, and the country of origin, a short description of each species or variety is given, together with an

indication of its distribution and natural habitat, and of its economical characteristics. It is hoped that the list will be useful to the scientific workers in various parts of Australia who collaborate with the Section in testing the plants introduced.

Noteworthy introductions during the period include many varieties of cotton for trial either in northern or southern Australia (26841-43, 26874-75, 26931-43, 26948-50, 26980-85, 27003-06). These include varieties suitable for mechanical harvesting and for cultivation under irrigation, as well as others resistant to major diseases. Seed of potato hybrids (26847-61) will be used for breeding work with this crop in Tasmania, and will minimise the quarantine risks involved in the introduction of tubers. Collections of tropical varieties of French beans from Colombia and Mexico (26876-912, 26952-53) may extend the scope of bean cultivation in tropical Queensland.

152. Australia: C.S.I.R.O. - Sub-speciation in subterraneum clover

Trifolium subterraneum L. is an annual, self-fertilizing legume, derived from the Mediterranean region, now widespread in parts of Australia. The discovery of sterility in some F_1s led to an investigation of the genetic structure of this species. Twenty "Australian" strains could be divided, on the basis of fertility of F_1s and later generations, into one set of sixteen strains (Group A), the two others, B and C, each containing only two strains.

Fertile F_1s were obtained in crosses of the Australian Group A with 6 of 11 strains from the Iberian peninsula, 4 of 10 strains from Morocco, 2 of 6 from Algeria, 2 of 2 from Turkey, and 1 of 4 from Greece. Other crosses with A strains produced infertile or non-viable F_1s, as did crosses of A strains with single strains from each of Israel, Cyprus and the Canary Islands. Of 21 F_1s from crosses among strains incompatible with Group A, the majority from different regions, all were highly sterile or non-viable. Thus there appear to be numerous sub-species in the original habitat. The Australian sample differs from the Mediterranean sample in containing such a high proportion of strains in Group A, and representatives of only three affinity groups. This suggests that these introductions to Australia came from a restricted portion of the original habitat.

There are no indications that affinity groups other than A are widespread, as would be expected if the distribution of A were determined by migration. The pattern of distribution observed suggests that subspecific differentiation occurred on many independent occasions, and in a variety of locations, rather than at a centre of variation.

(MORLEY, F.H.W. 1958. Sub-speciation in Trifolium subterraneum L. (Abs.) Proc. 10th Int. Congr. Genetics, Vol.II, pp.194-5)

153. New Zealand: Use of maize by Maoris

The earliest recorded introduction of maize, Zea mays, into New Zealand may be dated back to 1772 in two separate accounts of Marion du Fresne's voyage by Roux and Crozet. In both journals, accounts are given of the sowing of maize and other vegetable seeds in the Bay of Islands, Northland. This and subsequent early introductions are referred to by Best in his account of Maori agriculture.*

Of the many vegetables introduced since the first European settlement,

* BEST, Elsdon. Maori agriculture. Dominion Museum Bull. 9: 1925 (Wellington).

the only kinds which could be described as absorbed by the Maori to become standard items in their gardens were potatoes, squash and maize. These supplemented the rather short list of cultivated plants used for food.** With the new varieties of potatoes (Solanum tuberosum L.) and squash (probably Cucurbita pepo L.) which became available in the 19th and early 20th centuries, the older introductions were discarded by the European populations, but many of these survive to the present, owing to their conservations by the Maoris in rural areas, mainly in the North Island. Whether the earliest introductions have been saved cannot be opined, but the collection of potatoes to be described in a separate study contains many which have not been grown by Europeans within living memory. With maize there is less possibility of the very early types being saved since the Maoris, whose own agricultural crops were in the main vegetatively reproduced, did not adapt readily to grain harvesting as a means of plant perpetuation. However, in a short span of time, the Maori developed his own standards for seed saving and utilization, which together form the subject of this account.

Distribution and general description.

Maize is grown in Maori gardens in the North Island of New Zealand as a summer crop, from latitude 40°S northward. These gardens may be either fenced enclosures in farm fields or they may adjoin houses in small Maori communities. Invariably squash is planted in association to be harvested after maize. It would be difficult to estimate the acreage of such a generally grown family kitchen type of crop, but the greatest concentrations seem to be in the area of Northland, Hawkes Bay, Poverty Bay and the Bay of Plenty. In the latter two districts, maize is an important agricultural crop, and hybrid maize of U.S. origin is used extensively.

There can be no firm description of Maori maize. Either through the saving of heterogeneous material without rigid selection, and/or the spasmodic introduction of new parental material from agricultural sources, there is considerable variation from place to place and within any one stock. In general Maori stocks are usually characterized by tall, vigorous, single-stalked plants, and the majority are deep-yellow grained and starchy. However, variations in these characters exist as well as in rows per ear (eight to fourteen), straightness of rows, smoothness and shape of grains, cob color and maturity. Fig. 1* shows samples from two areas in Northland. The two donors are of the same tribe, but maize selection has been going on separately. They may not have started with the same stock, and certainly in recent times they have had access to different introductions.

Sweet corn has not found particular favor with the Maoris who seem to prefer the starchy maize even for use in the immature stage. The writer has not encountered many families who claim to have kept their own sweet corn seed for any length of time, although all have grown it at one time or another. Other introductions, though, have been accepted, and one is liable to come across unexpected types in out-of-the-way places. A black grained corn similar to the Black Mexican sweet corn is occasionally encountered in the far North. Fig. 2* shows some of the recent introductions, including some popcorns which were introduced during World War II, and seed saved since. U.S. hybrid agricultural maizes have been grown recently by Maoris in the Bay of Plenty area. They do not save seed from these partly because they have been advised not to, but mainly because many had tried when hybrids were first introduced.

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* See original article.

** See reference on page 32.

The vernacular name covering all maize is kaanga.

Conclusion

At the first contacts of Maori and European, one of the first exchanges involved food and food plants. The Maoris received food plants from the European which he desired to be propagated for his use. The Maori took those which he preferred, and in a way, retreated with them to "re-domesticate" them under his own environment and to his requirements. With success, he cultivated and perpetuated such a crop as potato which was similar to his older crop the kumara or sweet potato, but with maize he seemed to be only progressing toward a seed culture with his own standards of selection. His adaptations of it to his taste, whether by his own invention or by introduction, became stabilized to become a near-essential in his diet. It may be idle to speculate that the further inroads of European values into Maori life have limited the traditionalizing of the uses and culture of the early food plant introductions.

(YEN, D.E. 1959. The use of maize by the New Zealand Maoris. Econ. Bot., Vol.13, No.4, pp.319-27)

154. Papua and New Guinea: Collection of sugar cane

The following is an extract from a letter of 9 August 1960 received from Mr. G.P. Keleny, Department of Agriculture Stock and Fisheries, Port Moresby:-

With reference to item 126 in Plant Introduction Newsletter No.7, it might be mentioned that Prof. Dr. J.J. Ochse, Professor of Botany, University of Florida, Miami, U.S.A., visited Papua and New Guinea during May-June 1960 to carry out the field collection of wild and domesticated varieties of bananas (Musa spp.) which are assembled under the sponsorship of the United Fruit Company for use in breeding for disease resistance. Collections were made at various locations in the Central District of Papua and the Morobe, Madang, New Britain, New Ireland and Bougainville Districts of New Guinea. Prior to visiting Papua and New Guinea, Dr. Ochse has spent some time collecting in Netherlands New Guinea.

155. South Pacific Commission - Plant Collection and Introduction Newsletter No.8

Included in the above-mentioned Newsletter is a list of the main cash crop propagation material available at Naduruloulou Plant Introduction and Quarantine Station:-

Cocoa (Theobroma cacao)

Local selections: S535, S1070, S61, S77
Imperial College selection: I.C.S.1, 8, 25, 40, 60, 84, 89, 95
Amazonian: N.A. 32, P.A. 35
Grenada selection: GS29, GS36
(Cuttings and/or seeds available of all the above material)

Coffee (Coffea spp.)

Coffea arabica U.S.D.A. types, Fiji type and New Caledonia type
Coffea canephora (Robusta) 5 types mixed from U.S.D.A.
Coffea liberica
(Seeds of the above material available)

Black pepper (Piper nigrum)

1 Borneo type, 6 Indian types and 1 Madagascar (ex-Tahiti) type
(Cuttings available)

156. South Pacific Commission: Plant Exploration and Introduction Officer

We understand that Mr. John Parham, Economic Botanist, Department of Agriculture, Fiji, has been seconded to the South Pacific Commission for a period of six months as Plant Exploration and Introduction Officer. As part of his project, Mr. Parham visited Papua and New Guinea to study the variability within stands of coconuts and breadfruit.

157. U.S.A.: Cytogenetics of Safflower

Safflower, Carthamus tinctorius L., is grown at present in the United States for the high quality drying oil that is extracted from its seeds, and it is assuming an increasing economic value in Californian agriculture. It has been grown as a minor crop for several thousand years, however, for the red dye extracted from its flowers. There has been very little research on safflower or related species until recently. A cytogenetic study has been undertaken by Ashri and Knowles* in order to understand better the nature of the genus, to study the inter-relationships of the wild species with each other and with the cultivated species, and, finally, to assay the feasibility of transferring desirable characters from the wild species to the cultivated one. The progenitor of cultivated safflower could not be determined with certainty.

On the basis of chromosome numbers, morphology and interspecific hybrids, 9 species of Carthamus were assigned to 4 sections. In Section I, with 12 pairs of chromosomes, are C. oxyacantha, C. palaestinus and C. tinctorius; in Section II, with 10 pairs, are C. alexandrinus, C. glaucus, C. syriacus and C. tenuis; in Section III, with 22 pairs, is C. lanatus; in Section IV, with 32 pairs, is C. baeticus. C. arborescens and C. caeruleus, both with 12 pairs of chromosomes, were not assigned to sections because of their failure to hybridize with other species and their distinct morphology.

There are 2 basic chromosome numbers in the genus: x = 10 and 12. It was not possible to say which came first in the evolutionary scale. The species assigned to Section I are closely related. The species of Section II were not studied sufficiently to establish relationships between them. The species of Section I are distantly related to those of Section II. C. lanatus is an amphiploid, having a 12- and a 10-chromosome genome. Species of Section II appeared to be more closely related to C. lanatus than those of Section I. C. baeticus is an allohexaploid, having a 12-chromosome genome and 2 different 10-chromosome genomes. It appeared to be the product

*See also items 47 and 130 (Plant Introduction Newsletters Nos. 3 and 7)

of hybridization between C. lanatus and some species with 10 pairs of chromosomes. The latter species was not identified, but on the basis of its morphology is believed to be either C. leucocaulos or C. nitidus.

(ASHRI, Amram and KNOWLES, P.F. 1960. Cytogenetics of Safflower (Carthamus L.) species and their hybrids. Agron. J., Vol.52, No.1, pp.11-17)

158. U.S.A.: American Association for the Advancement of Science

The Agricultural Section of the AAAS devoted the entire programme at its meeting at Chicago, Illinois, 27-30 December 1959, to a Symposium on "Germ plasm resources in agriculture: Development and protection". Germ plasm of both plant and animal origin was covered during the 3-day symposium but only the contributions on plants are referred to here. Dr. Ralph W. Phillips, Director of International Organization Affairs, Foreign Agricultural Service, U.S. Department of Agriculture, in his paper "Untapped sources of animal germ plasm" stated that, in contrast to the activities of plant explorers, the United States had been conservative concerning animal exploration. Thus there exists a great deal of animal germ plasm which has not been utilized or examined for potential use in the United States.

Among the symposium speakers was the Honorable Henry A. Wallace, former Vice-President and Secretary of the U.S. Department of Agriculture. Mr. Wallace urged the plant and animal geneticists to be continually on the lookout for unique genes which should be preserved for their potential future value to agriculture. Such genes, which may provide a source of resistance to insects, diseases, etc., may be lost forever unless efforts are made to preserve them. He suggests that a germ plasm programme, such as the one sponsored by the National Science Foundation for corn germ plasm, be extended to other crops. The function of pure breeds of animals is to furnish stock of known functional ancestry for purposes of cross-breeding. Pure stock is necessary mainly as breeding material and should be preserved.

The "Need for and utilization of additional sources of germ plasm" was discussed by Dr. H.A. Rodenhiser, Assistant Administrator (Farm Research), of U.S.D.A.'s Agricultural Research Service. Current world collections have been fairly adequate in meeting the needs for germ plasm with which to keep abreast of many of the major crop problems in the U.S.A. Success may be temporary as present varieties may not be adequate to resist attacks of new races and biotypes of pathogens and strains of insects which repeatedly appear. The problem may be complicated to a further degree by the introduction into the U.S.A. of diseases and races of pathogens, insects and insect vectors from other countries. "Enanismo" disease of cereals in Colombia and Ecuador, sugar beet yellows in Chile, bacterial stalk rot of corn in India, and sugar cane smut in several countries of the world were cited as potential threats to U.S. agriculture. Expanded research for new germ plasm, more detailed evaluation of current stocks, identification of parasitic races of pathogens on an international scale, and basic research to determine limits of pathogenicity of races must be undertaken in order to effectively combat the various hazards of disease and insect attacks, cold and frost injury, and drought.

"Geographic origin of plants useful to agriculture" was presented by Dr. Jack R. Harlan, Geneticist, Crops Research, A.R.S., U.S. Department of Agriculture, and Professor, Department of Agronomy, Oklahoma State University, Stillwater, Oklahoma.

Most of the great variability of crop plants can be accounted for by introgressive hybridization between different races of the crop in question and between the crop and its weed forms. The weed forms of crop plants are generally too specialized and derived to be progenitors of crops, but they have played enormously important roles in the evolution of crop plants.

An understanding of how crop plants evolved is important to the improvement of our present crops and to the introduction and utilization of new ones.

Centres of diversity are in great and immediate danger of extinction. Resources of this type can never be replaced. The situation demands urgent action to collect and preserve world germ plasm resources before it is too late.

"Need for additional sources of germ plasm in horticultural crops" was presented by Dr. F.P. Cullinan, Crops Research Division, U.S.D.A.'s Agricultural Research Service, Beltsville, Maryland.

Agriculture in the United States developed from introduced plants. Only a few of our food crops were indigenous. Over the centuries, since their introduction from the wild, horticultural crops now grown have been improved by selection and hybridization. Most basic germ plasm for our domestic horticultural industry reached us from Europe or southern parts of the western hemisphere.

Since the Department of Agriculture was established in 1862, a concerted effort has been made to bring in new germ plasm as a source of possible new crops and for the improvement of crops under cultivation. Need for improvement has been continuous. One of the principal needs has been disease-resistant varieties. Under intensive agriculture new problems of susceptibility to diseases, nematodes, insects, cold and drought arise. New varieties must be developed to meet present changes in technology, processing and consumer preferences. The great progress in genetic research in the past 25 years includes new scientific tools and techniques that should speed up crop improvement.

Some of the germ plasm introduced in the early part of this century had been lost, but much has been preserved as living plants and seeds at the Plant Introduction Stations of the Department and at the State Agricultural Experiment Stations. Some of it needs further study in the light of present-day knowledge. In the past ten years the Federal Government gave further assistance to the introduction and testing of horticultural germ plasm in four of the principal producing regions of the United States. Also it provided for a National Seed Storage Laboratory for storage and preservation of seed in cooperation with the States.

"Need for and utilization of additional sources of germ plasm in field crops" was presented by Dr. Martin G. Weiss, Associate Director, Crops Research Division, U.S.D.A.'s Agricultural Research Service, Beltsville, Maryland.

Germ plasm of the plants that supply us with food, feed, and fiber ranks high in importance among the world resources. Long after man has exhausted certain of our natural resources, he will be dependent on living plants to feed and clothe him.

As compared with other resources, germ plasm is highly unstable. Although its instability has permitted the evolution of highly diverse characters, it also contributes to the difficulty of maintaining adequate diversity. The future potential of this resource rests upon man's ability to recognize and preserve germ plasm needed in the future.

The range of adaptation of certain of the presently grown crops has been broadened appreciably by introduction and incorporation of germ plasm that altered maturity or provided greater resistance to parasites and climatic hazards. As a consequence, production belts have been extended. Greater germ-plasm diversity presents the potential of broadening the regions of production of a number of additional crops. Similarly, certain plants presently not grown commercially may be developed into crops with economic potentials.

"The use of diverse germ plasm in the improvement of some forage legumes" was presented by Dr. Herman J. Gorz, Geneticist, Department of Agronomy, University of Nebraska, Lincoln, Nebraska, and Dr. W.K. Smith, Professor, Department of Agronomy, University of Wisconsin, Madison, Wisconsin.

Two genera of the forage legumes, Medicago (alfalfa) and Melilotus (sweet clover), provide contrasting illustrations of the successful use of germ plasm outside the cultivated species. A species of alfalfa, Medicago falcata, was recognized many years ago for its remarkable cold resistance and drought tolerance. Representatives of this species have been found in Siberia and other areas of Asia. By combining the characteristics of M. falcata with those of the species M. sativa, five improved varieties have been released for commercial use during the past 15 years. On the basis of these accomplishments to date, it is likely that strains of M. falcata will make additional contributions to alfalfa improvement.

Diverse germ plasm also has been successfully utilized in the improvement of sweet clover (Melilotus). Prominent among the undesirable traits of sweet clover as a forage crop is the high content of coumarin that is found in commonly-grown varieties. Initial attempts at breeding a low coumarin variety of sweet clover were concentrated upon the isolation of a coumarin-free plant. More than 900,000 sweet clover plants were tested for coumarin in this search. However, no low-coumarin varieties have been developed in this way. On the other hand, through knowledge of the inheritance of coumarin content in many different species, hybridization and inbreeding have been utilized to develop lines which were low in coumarin.

Larger size of seed is another important observation in sweet clover breeding programmes. Two recent introductions of sweet clover seeds, one from Turkey and the other from Tunisia, are being used in an effort to increase the size of seed in low coumarin lines.

"Perpetuation and preservation of germ plasm as seed", by Dr. Edwin James, National Seed Laboratory, A.R.S., U.S.D.A., Fort Collins, Colorado.

The loss of many potentially valuable world collections of seeds and old standard varieties has demonstrated the need of a programme of seed preservation for posterity. Many fruitful areas for the collection of germ plasm are no longer open to American plant explorers and, therefore, measures are necessary for the preservation of stocks still available.

To provide for the preservation of germ plasm, steps taken by various agricultural agencies in the United States led to the building of the

National Seed Storage Laboratory in Fort Collins, Colorado. The laboratory provided eleven cold storage rooms with controlled humidity. Laboratory facilities for germination tests and research work are also incorporated.

An advisory group recommends broad policies for the operation of the laboratory, and crop commodity committees set up standards for the acceptance and maintenance of their respective crop seeds.

Other topics related to plant germ plasm were "Using germ plasm for new products" by Quentin Jones, U.S.D.A., and "Irradiation and plant improvement" by R.S.Caldecott, University of Minnesota.

In summarizing, it may be said that the symposium served to point out the need for steps to be taken to preserve existing sources of plant and animal germ plasm in order that potentially valuable genes may not be lost forever.

(Report by Dr. Roy C. Dawson, Technical Officer, FAO Regional Office for North America, Washington, U.S.A.)

159. U.S.A.: Origin of domestic tung industry

The tung tree, Aleurites fordii Hemsl., is native to central and western China. Its fruits yield a superior drying oil, which the Chinese have used for hundreds of years for making lacquers and varnishes, for waterproofing, and for other purposes. In the late 1800's, American paint and varnish manufacturers began to import increasing quantities of tung oil from China. Believing that the tree would be climatically adapted to some of the warmer sections of the continental United States, L.S. Wilcox, Consul General at Hankow, China, sent seed to the Section of Plant Exploration and Introduction, U.S. Department of Agriculture, in 1904. Seedlings were grown at Chico, Calif., and sent to cooperators in various parts of the United States. Several of the trees planted in the southeastern States grew satisfactorily. One tree planted in 1907 near Tallahassee, Fla., by W.H. Raynes, produced a crop of fruit in 1913, from which officials of the American Paint, Varnish and Lacquer Association, Inc., extracted the first 2.2 gallons of American tung oil (1).

Interest in this new exotic tree grew by leaps and bounds. The American Tung Oil Corporation, organized largely by manufacturers of paints and varnishes, planted a trial orchard near Paradise, Fla., and plantings by other private interests increased steadily. By 1930, nearly 8,000 acres of tung orchard had been planted in Florida, and extensive plantings were being made on the cutover pine lands of Mississippi and Louisiana. By 1938 there were roughly 200,000 acres of tung orchard in the southeastern United States, mostly in Mississippi, Florida, and Louisiana, but to a lesser extent in Alabama, Georgia and Texas. Planting since 1938 has been on a moderate scale. A good general review of the development of the tung industry was published by Blackmon (2) in 1943.

(1) NEWELL, W. 1924. Preliminary report on experiments with the tung-oil tree in Florida. Fla. Agr. Exp. Sta. Bull. 171, 41 p.

(2) BLACKMON, G.H. 1943. The tung-oil industry. Bot.Rev. 9, pp.1-40.

(POTTER, George F. 1959. The domestic tung industry. I. Production and improvement of the tung tree. Econ. Bot., Vol.13, No.4, pp pp.328-342)

160. U.S.A.: Alfalfa varieties

Germ plasm used in developing varieties

Nature has provided three principal stocks of alfalfa from which all varieties in the United States are derived. These basic stocks are the two species Medicago sativa and M. falcata and an intermediate stock known as variegated alfalfa. Variegated alfalfa is believed to have resulted from natural crossing between the two species, followed by natural selection. Some scientists have placed variegated alfalfa in a species by itself and called it M. media.

Medicago sativa is purple flowered, narrow crowned, and erect. Strains of this species vary greatly in winter hardiness, but as a group they are less hardy than M. falcata. The latter is yellow flowered and decumbent, and has widely branching roots and a deep-set crown. M. falcata is extremely winter hardy. This species yields considerably less forage and seed than M. sativa. The variegated alfalfas found in nature provided the principal sources of germ plasm for the first hardy varieties.

Plant breeders have continued to hybridize and recombine the numerous types in the three basic stocks found in nature in order to develop varieties that meet the changing needs of the American farmer. From 10 to 15 years are usually required to develop and test a variety before its release. Varieties have been released in less than 10 years, but this shorter period for testing is usually done in an emergency, such as the one created by the advent of the spotted alfalfa aphid.

(HANSON, C.H., GARRISON, C.S., GRAUMANN, H.O. 1960. Alfalfa varieties in the United States. US Department of Agriculture "Agriculture Handbook" No.177, p.3)

161. U.S.A.: Latar Orchardgrass (Dactylis glomerata)

Mr. Edwin O. Nurmi, Superintendent, SCS Plant Materials Center, Pullman, Washington, has, in an article in Seed World of 12 August 1960, described the origin of this new variety of Dactylis glomerata and has quoted reports of farmers' experience in growing and feeding it. Seed of this type was sent to the United States by the Westover-Enlow expedition in 1934. The sample was given to the expedition by the Institute of Plant Industry, Leningrad, and sub-samples were distributed to various places in the United States for comparative testing. In 1935 a small quantity of this seed, then labelled PI-111,536, reached the Soil Conservation Service Plant Materials Center at Pullman, Washington. During subsequent years the material was further tested and selections were made until in 1950 it was possible to produce bulk seed from the remaining plants. The selection was then called P-2453. After further selection, Latar was released in 1957 in Washington and Idaho, and in 1960 in Oregon. Commercial seed production has been increasing during the past 2 years in Washington and Idaho and it was estimated that 75,000 pounds of seed were available for

1960 plantings. The variety is particularly well adapted to fields of high fertility in irrigated areas and to fertile dryland areas with more than 18 in. annual precipitation.

(NURMI, Edwin O. 1960. Latar Orchardgrass. Seed World, No.87, No.3, pp.6-8)

162. Mexico: Fertility and late blight resistance in a Mexican wild potato

The Mexican wild potato species Solanum bulbocastanum Dun. has commanded the interest of potato breeders ever since it was found to be almost always immune to late blight of potatoes caused by Phytophthora infestans (Mont.) de Bary. Various workers (3, 5) have reported it immune after artificial inoculation with all their available physiological races of the pathogen. Also, Niederhauser and Mills (4) were unable to find authentic blight lesions on plants which had been exposed to an epiphytotic of the disease in the Valley of Toluca in Mexico during 1952.

Material of the species which has been available to potato breeders in the past has consisted of a few clones collected by Dr. Donovan S. Correll (2) in 1947 and by Dr. J.G. Hawkes (3) in 1949. Although with one exception these clones were immune to blight, attempts to produce hybrids between S. bulbocastanum and S. tuberosum were impeded by the fact that the immune clones were both self- and cross-sterile. The nature of the sterility was traced by Hunter (personal communication) to the fact that available clones in the U.S. and Canada were triploids with a chromosome number of 36. The single available diploid accession, P.I. 161156, was fertile but it segregated for susceptibility to blight according to Black and Gallegly (1). It therefore became a highly desirable objective to acquire by extensive collecting in Mexico a number of diploid, fertile and blight-immune clones of the species.

Collections

S. bulbocastanum was collected throughout its range in central and southern Mexico and Guatemala during the rainy seasons of 1956 and 1957. In June and July it was possible to find plants in a vigorously growing condition suitable for transplanting, and living plants were brought back from the field in pots of soil. After they became established in the greenhouse they produced flowers in abundance and it was possible to perform many self- and cross-pollinations among the various clones. In late August and September the collections consisted of tubers and ripened fruits.

The species was found frequently around rock piles, in old lava beds, in ruins, and in the protection of cactus and maguey (Agave sp.) in semiarid locations at altitudes ranging from 5000 to 8400 ft. above sea level. It was most interesting to note its relative profusion in and about certain archaeological sites. It was found on the pyramids of Cuicuilco and Cholula; in the ruins of the ancient city of Monte Albán, seat of the Zapotec culture in the Valley of Oaxaca; and at Zaculéu, Zacapulas, Utatlán, and Lake Atitlán in the highland Maya region of Guatemala. Naturally its presence here raises the question as to whether the species was ever cultivated. If we base our conclusions upon the results of cooking and tasting tests, it seems rather doubtful that the ancient Indian peoples used the tubers as food. It is more likely that S. bulbocastanum, in common with many other members of the genus Solanum, flourishes as a weed in the disturbed soil of the sites of the old civilizations.

Abstract

S. bulbocastanum Dun. was collected extensively throughout its range in Mexico and Guatemala. Experimental self- and cross-pollinations showed that the species is highly self-sterile and consists of cross-sterile and cross-fertile individuals. Self-sterility may be due to the presence of incompatibility factors or to triploidy. Authentic hybrids were produced between S. bulbocastanum and S. trifidum Correll, and between S. bulbocastanum and S. pinnatisectum Dun.

After inoculation with race 1.2.3.4 of Phytophthora infestans three types of reaction were observed among 1148 seedlings of S. bulbocastanum: immunity with no perceptible lesions, resistance expressed by non-sporulating lesions of the hypersensitive type, and susceptibility indicated by large sporulating necrotic lesions. Seedlings resistant to an isolate of race 1.2.3.4 of Canadian origin did not always show the same level of resistance to a Mexican isolate of the same race. Varying degrees of field resistance were observed among seedling plants, while tuber-propagated plants were generally field immune. S. bulbocastanum is considered a mixture of resistant and susceptible genotypes.

Bibliography

1. BLACK, W. and GALLEGLY, M.E. Screening of Solanum species for resistance to physiologic races of Phytophthora infestans. Am Potato J. 34, 273-281 (1957).
2. CORRELL, D.S. Section Tuberarium of the genus Solanum of North America and Central America. U.S.D.A. Agriculture Monograph No.11. U.S. Government Printing Office, Washington. 1952.
3. HAWKES, J.G. Some observations on South American potatoes. Ann. Appl. Biol. 34, 622-631 (1947).
4. NIEDERHAUSER, J.S. and MILLS, W.R. Resistance of Solanum species to Phytophthora infestans in Mexico. Phytopathology, 43, 456-457 (1953)
5. REDDICK, D. Frost-tolerant and blight-resistant potatoes. Phytopathology, 20, 987-992 (1930).

(GRAHAM, K.M., NIEDERHAUSER, J.S. and SERVIN, Leopoldo. 1959. Can. J. Botany, Vol.37, pp.41-9)

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163. Argentina: Origin of potatoes

After considering the historical details and field observations of primitive potatoes on the island of Chiloé, the author comes to the following conclusions.

The proponents of the theory of a Chilotan origin of cultivated potatoes cannot name a wild Tuberarium species which combines the necessary taxonomical, cytological and morphological characters which are required from such a "Urform" (ancestral type) in the phylogeny of cultivated potates. Russian authors argued in favour of a Chilotan origin of the potato on the basis of photoperiodic and ecological considerations, but this evidence is not critical. Certain potato varieties are known from

the Altiplano (3700-4000 m.) in the short-day zone, which, however, have a neutral reaction, producing well in the European or Chilotan long days. The author also collected highland potatoes on the Pacific coast of Chiloé which were growing extremely well only 20 m. above sea level.

Diploid potatoes also exist in cultivation on Chiloé and are possibly of the same Solanum stenotomum (s.l.) group which was previously considered to be endemic to the Altiplano. Also it is demonstrated that a triploid found on Chiloé under the name "Palmetta" exists in an identical form in the mountain east of Humahuaca (Prov. Jujuy) in North Argentine.

Another typical highland crop, Oxalis tuberosa, is also cultivated on the island of Chiloé, demonstrating that another cultivated species selected under the high mountain conditions of Peru and Bolivia, also grows well in the different photoperiodic and ecological conditions of Chiloé at a latitude of 50°. It is suggested that this tuber-bearing Oxalis was introduced in association with altiplano potatoes from the North to Chiloé.

Ninety per cent of the island of Chiloé is covered with dense evergreen woodland, where no diploid wild potato has yet been found. If in reality, Chiloé was the centre of origin of cultivated potatoes, it would be necessary to show how, under such conditions, so great a diversity of cultivated varieties has arisen. In such a case, from a relatively small island on the periphery of the potato area, the cultivated potato must have invaded a region more than 2000 km. distant where over 150 wild tuber-bearing species are known. Some of these species are - without doubt - closely related to the cultivated forms. The suggestion is made that there was a potato migration from North to South sometime in the past, but not from a supposed "Chilotan gene centre" across the Cordillera towards the Altiplano.

(BRUCHER, H. 1960. Problematisches zum Ursprung der Kulturkartoffel aus Chiloé. Zeitschrift für Pflanzenzüchtung, Band 43, Heft 3, pp.241-65).

164. Australia: Chilean plants under test

Plants collected by Mr. E.T. Bailey during a visit to Chile in 1958 are now undergoing preliminary testing at the C.S.I.R.O. Plant Introduction Section's quarantine station at Kelmscott, near Perth, Western Australia.

Main object of the one-man plant exploration project was to find annual and perennial pasture plants suited to Mediterranean-type climates, and especially to the drier areas of Western Australia. Most of the plants were collected in areas of average annual rainfalls from 4 inches to 25 inches.

Possibly the most interesting plant brought back by Mr. Bailey is an unusual perennial clover. It spreads like white clover by rooting along the stems but has a taproot which penetrates deeply using moisture reserves eight or more feet below the surface. However, it did not do particularly well during the first season at Kelmscott.

A relative of brome grass appears to be the most promising of the annual grasses in the collection. A strain of Phalaris tuberosa which does not shed its seed and is possibly self-fertile may prove useful, particularly in breeding programmes.

The present small-scale testing will continue for 3 years, and it may be 10 years before field testing is completed and any commercially valuable material is ready for release.

(Extract from "Rural Research in C.S.I.R.O. No.32, June, 1960, pp.26-7)